

**CRANFIELD UNIVERSITY**

Parminder Singh Sahota

The development and application of cultural archetypes for  
understanding innovation capability.

**INTERNATIONAL ECOTECHNOLOGY RESEARCH CENTRE  
(SIMS)**

**PhD Thesis**

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innovation capability.**

Supervisor: Mark Lemon

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“This thesis is submitted in partial fulfilment of the requirements for the degree of PhD”

## **Abstract.**

This thesis recognizes that organizational culture is a primary determinant of innovation capability and argues the need to better understand this relationship or process as a necessary prerequisite to nurturing it in a more structured and systematic manner. The study explores this relationship within an R&D environment in telecommunications. It draws upon the knowledge management, organisational behaviour and organisational theory literatures to conceptualise organisational culture as a repository of knowledge. Using a soft systems bottom up approach four cultural archetypes with specific knowledge dynamics are identified and developed through a three-phase multi-method research strategy. These provide a clearer understanding of the relationship between organisational culture and innovation capability. The thesis concludes by considering strategies for improving innovation capability through the effective and appropriate movement between these archetypes.

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## **Chapter 1: Towards innovative capability.**

### **1.1 General introduction and purpose of chapter.**

This chapter begins by presenting a short review of some general concerns about the study of organisational culture as it relates to innovation capability. The INTA/BT study that describes the background to this study and identifies a broad set of aims and objectives for future work is presented next. The Exploratory Phase of research which leads to the identification of four substantive issues of interest to BT, the identification of six research domains that would be the focus of the study and a conceptual framework are described next. These then lead to the identification of a specific aim, a set of objectives and a multi-method approach to this study. The chapter concludes with a brief introduction of the literatures that are used in the study and the presentation of the thesis structure.

### **1.2 Some general concerns about the study of the culture as it relates to innovation capability.**

Innovation has become the mechanism by which organisations produce new products, processes and systems for adapting to changing markets, technologies and modes of competition (D'Aveni, 1994; Dougherty and Hardy, 1996; Utterback, 1994). The emergence of the knowledge economy, intense global competition and considerable technological advance has seen innovation become increasingly central to competitiveness. The ability to develop new ideas and innovations is a top priority of organisations (Porter and Stern, 1999). Hurdles to success, however, have increased considerably as firms become focused increasingly on innovation and higher levels of commitment to innovation are required to maintain the status quo let alone improve competitive position.

Managing the complex and risky process of innovation has been problematic (Kanter, 1989; Quinn, 1985) and evidence suggests that a number of core elements and processes exist which aid effective innovation capability (Tidd, *et al.* 1997). This is defined as the propensity of the firm to innovate or what Rogers (1995) describes as organisational innovativeness. Of these elements or processes an appropriate culture within the organisation is central to innovation success.

The concept of culture continues to strike managers and management-oriented writers as a key variable in the success or failure of organisational innovations. There has

however been little effort to synthesize the dimensions of organisational culture that have been studied to date or, more importantly, to identify which of these are most related to improved innovative capability.

This lack of consolidation, followed by systemic empirical research, has led some to argue that interest in organisational culture as a driver of organisational innovation and performance is likely to fade unless this dearth of research is addressed (Firestone and Louis, 1998; Pettigrew, 1990; Reichers and Schneider, 1990; Smart and St. John, 1996). This study, through empirical research, addresses and examines some of these issues.

### **1.3 Background to the research project.**

This section provides the background to this study. In 1997 the Innovation and Technology Assessment Unit (INTA) of Cranfield University undertook a study on the topic of organisational modelling for the Business Modelling team at BT (Seaton *et al.* 1997). The Business Modelling Group was a research domain within the research community at BT's Adastral Park and was involved with researching and developing new techniques and approaches to current issues and problems. It was later incorporated into BTeXact following organisational changes.

The function of the study was to critically review the available intellectual resources that BT might tap into at INTA and to identify specific targets for further development. The focus of activity was the output of INTA's research on knowledge acquisition, organisational learning and the role of technology (including communication technology) in organisational evolution. The study's purpose was to identify and structure the objectives for further research that would create synergy between the long-term research programme at INTA and BT's capabilities in organisational modelling.

The proposed longer-term activity was to develop tools for understanding the knowledge dynamics of organisations, and to develop subsequent work on the modelling of organisations and future scenarios. The development of such capabilities were relevant to BT both in understanding its own possible pathways of development and also in enabling the company to understand how its customer organisations would evolve and new markets might emerge.

Some general questions and broad aims for further research were suggested including the use of ideas about knowledge dynamics as a potentially useful conceptual

framework for organisational modelling at BT. This could also provide a methodological approach.

### **1.3.1 Defining knowledge dynamics.**

Knowledge in this thesis is considered as a dynamic and renewable resource. The *types* of knowledge (tacit or explicit) are associated with either abstract or codified knowledge. Another consideration is the *nature* of knowledge (of being able to change or be changed from one state to another, for example from tacit to explicit). In addition to these, five *forms* of knowledge can be identified to explain the psychological and behavioural aspects of knowledge that are based on the explicit-tacit and individual-collective dimensions. These are embrained, embodied, encultured, embedded and encoded knowledge. Various combinations of these properties and their location are referred to as the knowledge dynamics of organisational culture and will be seen to have important implications to innovation capability in this thesis. Detailed literatures on these are presented in Chapters Five and Six.

### **1.3.2 Initial issues of interest.**

The INTA/BT study identified the following issues to be of interest. These revolved around the question of how managers could improve the process of fostering and managing innovation and included:

1. The identification of process/structure and relationships that could provide an understanding of the barriers and drivers to innovation.
2. The identification of the various approaches to innovation within the organisation that could enhance innovation capability throughout the organisation.
3. The need to increase the slack and adaptive capacity and therefore to identify factors that would facilitate flexible responses.
4. Tools and processes that could provide the ability to identify decision points and decision-making criteria. These would include insights for responding to significant variations in its operating environment.
5. The need to question, challenge, and change operating norms and assumptions and put in place the tools and understanding about appropriate strategic direction and patterns of organisation.

These issues of interest led to the development of a broad set of aims and objectives for future work within BT.

### **1.3.3 Broad aims and objectives.**

The following broad aims and objectives were developed by the INTA/BT study and were later revised into a specific aim and a set of objectives for this thesis.

1. To identify the competencies required for incorporating cultural characteristics into the models of organisation efficiency that BT had either previously developed or was in the process of developing.
2. To develop expertise in the development of strategy formulation for interventions specifically focused on cultural change across a number of possible frameworks.
3. To develop an understanding of the relationship between a number of research units within BT and their innovation capability including their operating environments.

Knowledge was also identified as being an essential feature of organisational evolution and gave rise to a more general consideration of the concept of knowledge dynamics as a critical property of organisations.

It had been shown from previous work carried out by INTA/BT that knowledge flows were complex in that they depended on interactions, which themselves were qualitative and took place between individuals, groups and the organisation. These ideas about knowledge dynamics suggested what was potentially a useful conceptual framework for organisational modelling at BT. However it needed some considerable development and generalization. It was suggested such a framework be developed as a tool to help the classification of the different cultures within the organisation with respect to their knowledge dynamics and possible evolutionary pathways. Suitably developed it could be used to identify organisational types and their evolution.

The INTA/BT study outlined concluded with the recommendation that further meetings with the BT's Modelling Group, who would be the contact between the sponsors of the proposed project (BT's Corporate Office), and INTA be held in order to discuss and refine the initial issues of interest and the broad aims and objectives identified above. These meetings would define the project for the research undertaken by this thesis and are described in the Exploratory Phase of research in the next section.

### **1.4 Exploratory Phase of research.**

The Exploratory Phase of research resulted in the following outcomes.

1. The identification of four factors that facilitated or constrained the process of innovation under differing conditions at BT. These are presented in section 1.4.1 and later considered to be substantive issues.
2. The identification of six research domains that would be the focus of this study and the development of a conceptual framework for looking at the organisation's innovation capability.
3. The identification of the specific aim and objectives of this study.
4. A multi-method research approach.

#### **1.4.1 The substantive issues.**

A first preliminary meeting between the Business Modelling team, INTA and this researcher was held to discuss how some of the broad issues, aims and objectives could be addressed through a single project. BT's Corporate Office, the official sponsor of the proposed project did not attend the meeting as the discussions were still at the initial stage. A number of specific issues that warranted further investigation were outlined.

One proposal was to look at the internal and external linkages of the organisation and map how ideas were conceived, "down streamed" and communicated inwards for further development in order to get the right perspective on organisational innovation capability.

*"This is an incredibly woolly process, is it a process or not?" BT analyst, Business Modelling.*

It was suggested that this was "too high a level" project. The issues were right but not the level. However, while it was necessary to get the right perspective, the research focus and design would not be clear for a few months. As the initial stages of research were diagnostic, it was not possible to write a formal statement of research and design. It was better to do things that were plausible and sensible and then try to learn about the situation and understand the context while located in the study environment. It would take about six months to specify the detailed context of the project and one year for the research design to be completed.

It was suggested that the best way to approach the proposed project was to start with people who were actively involved in the innovation process as a way of accessing the organisation, and subsequently networking essentially from the "bottom up". The people in the host organisation would be regarded as co-researchers validating the work locally. It was agreed that this would be a good way of learning about the organisation, and of providing a visible output early on in the study. The research



would be considered proactive as of the date of this first meeting. An important outcome of this meeting was the identification of the following factors, which were perceived to facilitate or constrain the process of innovation under differing conditions at BT.

1. BT recognised the value of innovation and the reliance of R and D upon it.
2. It was concerned that it failed to harness innovation effectively.
3. The organisation was aware that there was no specific domain for innovation.
4. BT was unclear how innovation entered the R & D process. In other words what were the barriers and drivers to the process?

A second meeting was held at BT's Adastral Park to discuss these four points. Present at the meeting were members of the Corporate Office and the Business Modelling Group. The discussion focused on the expected output of the research in terms of applicability. There was consensus that the organisation was going through a lot of change and combined with the competitiveness of the technology market it was essential that it should think about how to increase innovative capability. In light of the initial issues of interest and the broad aims and objectives described in Sections 1.3.2 and 1.3.3, the four points identified in this section would be considered as substantive issues. This meeting also developed the conceptual framework that is described next.

#### **1.4.2 The conceptual framework.**

Using three criteria (technological trajectories and core competencies, strategy, and the complexity of the environment) six research domains that would be the focus of this study were identified. A conceptual framework for looking at the organisation's innovative capability was then developed using these criteria and the domains mapped onto it. The interpretation of the different positions highlighted examples of cultural variation between the domains and it became evident that a key component that differentiated between contexts was not represented in this framework. The cultures that were evident within the organisation and helped to determine it as a whole had to be more clearly understood. The process of developing the framework is described in detail in Chapter Two.

#### **1.4.3 The specific project aim and objectives.**

Further discussions with the sponsors on the substantive issues in light of the conceptual framework developed led to the development of a specific aim and a set of objectives for this study.

The aim was to develop a conceptual model of organisational culture that would contribute to a better understanding of how it related to and affected innovation capability. This would be done by using “knowledge dynamics” as an approach and would be achieved through the pursuit of the following objectives.

1. The identification of key elements within organisational culture that affected innovative capability within the different domains of research.
2. The provision of a broader cultural context for these elements through a synthesis of previous BT studies on culture and this study.
3. The identification of the different cultural classifications and an understanding of their knowledge dynamics.
4. The consideration of strategic interventions based on these knowledge dynamics that could lead to improved innovation capability.

This would be achieved through the undertaking of a case study of innovation within an R&D context that would provide the contextual data and help validate the conceptual model on organisational culture being developed.

These specific aims and objectives tie in with both the initial issues of concern and the broad aims and objectives outlined in the INTA/BT study described earlier. These were primarily concerned with understanding the relationships between the differing research domains and their innovation capability and with strategies for responding to variations in their operating environments. The study had also identified knowledge dynamics as a critical property of organisations and the objectives outlined in this section necessitates its identification.

Further discussions also revealed that the transition from internal thought to external reality seemed inhibited and obstructed. These inhibitions rather than the shortage of innovative ideas seemed to be the problem.

1. *“There is no core identity, no mechanism for “bright” ideas to down stream”.*
2. *“It is difficult to introduce things quickly”.*

The innovation process itself was not very well understood. Ideas were not generated in any conscious or systematic way and the ideas that were thrown up were rarely well managed through phases of implementation.

1. *“Foresight” is not the problem, it is the mechanism”.*
2. *“There is no processional methodology – it is non-existent”.*

This had negative repercussions, for example in the neglect of creative individuals and in an inability to see research and development as a unified organisational task.

There seemed to be some anxiety about the ability of managers to manage the process of innovation i.e. trigger, generate, control and steer new ideas through the maze or “system”.

1. *“There is a lot of expertise but very low visibility”.*
2. *“There is a gap between the top and the bottom hierarchy, there is a large gap in-between these layers.”*

The research culture generated many ideas but was hostile to their development. This manifested both economically and managerially in things like lack of support from the Corporate Office and other sponsors, lack of supportive organisational structures, lack of incentives and the “not- invented here” syndrome.

1. *“Serendipity of the R&D process is non-existent. It is a financial point of view”.*
2. *“A lot of effort is required to make the system do what it is supposed to do”.*
3. *“It is “who do you know”.*

The crucial issue was that creativity must have some tangible outcome – in products, in services, in a new corporate strategy or more diffusely in a pervasive shift in corporate culture. There seemed to be a lack of balanced coalition between original thinkers and those that provided direction and stability.

*“There is no recognized process that takes innovation anywhere”.*

These views supported the outcomes of the conceptual framework and the specific aim and objectives of this study by suggesting that the relationship between organisational cultural and innovation capability had to be explored and understood.

The fieldwork of this research would be carried out at BT’s R&D facility (ACE, Advanced Communication Engineering) located at Martlesham, and later renamed Adastral Park. Adastral Park is at the core of BT’s new wave activity. The name was derived from the Royal Air Force’s motto *“Per Ardua Ad Astra”*, or through adversity to the stars and the Park’s logo is based on Ursa Minor (the Little Bear), the constellation that includes the Stella Polaris (Pole Star) at the furthest point of its “handle”. This star has been used for centuries by navigators to determine their location and guide their journey. Adastral Park is also home to BT’s Advanced Communications Technology Centre and the Martlesham Teleport. With the new name came a sharper commercial focus. Realizing it was in the middle of the biggest change in the history of the communications industry, BT had to act quickly to seize new opportunities.

#### **1.4.4 Research Techniques – a multi-method approach.**

In light of the aims and objectives, it was agreed that the fieldwork would involve the collection and examination of a variety of rich and disaggregated data sources. A multi-method approach was considered to be the most appropriate way of progressing the work. This approach is described in more detail in Chapter Three under research design and fieldwork execution.

The research techniques would be largely qualitative and in the form of discussions and semi structured interviews of the six research domains identified within Adastral Park. Document analysis, pertinent company reports and the company Intranet would also form part of the final analysis.

The bodies of literature that would be drawn upon to look at the identified substantive issues would include those on knowledge management, the dynamic capabilities of the organisation, systems thinking and systems archetypes. These are described briefly in the next section and a more detailed literature survey is presented in Chapter Five.

#### **1.4.5 Bodies of literature.**

This section describes in brief the bodies of literature that were used to inform and interpret the issues and aim and objectives outlined in Section 1.4.3. They are drawn from the broad literatures on knowledge management, organisational behaviour, organisational theory and systems thinking.

##### **1.4.5.1 Dynamic capabilities.**

Drawing from the literature on the evolutionary theories of the firm, the *dynamic capabilities* approach focuses on the relative ease or difficulty with which, and the ways in which, firms adapt in response to changes in their competitive environment. Recognition of the dynamic nature of interaction, and the fact that different levels of ability in firms to build and continuously renew essential competencies are linked to different levels of performance, and can be traced back to Penrose (1959). Teece and Pisano (1994) further developed the area proposing dynamic capabilities theory as the “subset of the competencies/capabilities which allows a firm to create new products and processes and to changing market circumstances”. Competitive advantage, therefore, rests on distinctive processes shaped by the firm’s asset positions and the evolutionary paths it follows. The dynamic capabilities approach emphasises management capabilities and inimitable combinations of resources that cut across all

functions, including R&D, product and process development, manufacturing, human resources and organisational learning.

#### **1.4.5.2 Knowledge management.**

Metcalf and Gibbons (1989) suggest that the “knowledge base” of the firm comprises of individual human resources and mechanisms of interaction. Firms in these knowledge-based industries generally have market values that are far greater than their conventional asset values because of their ability to generate future returns from their stocks and flow of intellectual capital. The ability of knowledge-based firms to outperform the marketplace rests on the continuous generation and synthesis of collective, organisational knowledge. This knowledge has been interpreted by Lam (1997, 2000) who suggests that it can vary along three dimensions: (i) the dominant form of knowledge in use and its tacitness, (ii) how knowledge and expertise is distributed and utilised within the firm (its structure), and (iii) the methods of coordination and knowledge transmission.

#### **1.4.5.3 Organisational learning.**

Although the terms “learning company” or “learning organisation” are relatively recent, the idea has been around for a long time and the relevant literature is voluminous. The development of systems thinking, and particularly the socio-technical systems view of organisations, is probably most responsible for allowing us to imagine organisations as organisms, as living things, that amongst other things learn. An organisation learns only in two ways: (a) by learning from its members, or (b) by ingesting new members (Simon, 1996). Clearly, individuals do learn within the context of the organisations, and that these contexts affect the performance of the organisation. But as Cook and Yanow (1996) have pointed out, individuals and organisations are different entities and there is no reason why organisational learning should be conceptually or empirically the same as learning by individuals or individuals learning within organisations.

#### **1.4.5.4 Systems thinking.**

*Systems Thinking* is, more than anything else, a mindset for understanding how things work. It is a perspective for going beyond events, to looking for patterns of behaviour and seeking underlying systemic interrelationships that are responsible for the patterns of behaviour and events and as such it embodies a world-view. These interrelationships are responsible for the manner in which systems operate. They also result in the patterns of behaviour and events we perceive. One of a class of systems

tools that capture the common challenges that occur in all kinds of industries and organisations is the systems archetype that will be used in the analysis and presented in Chapter Nine.

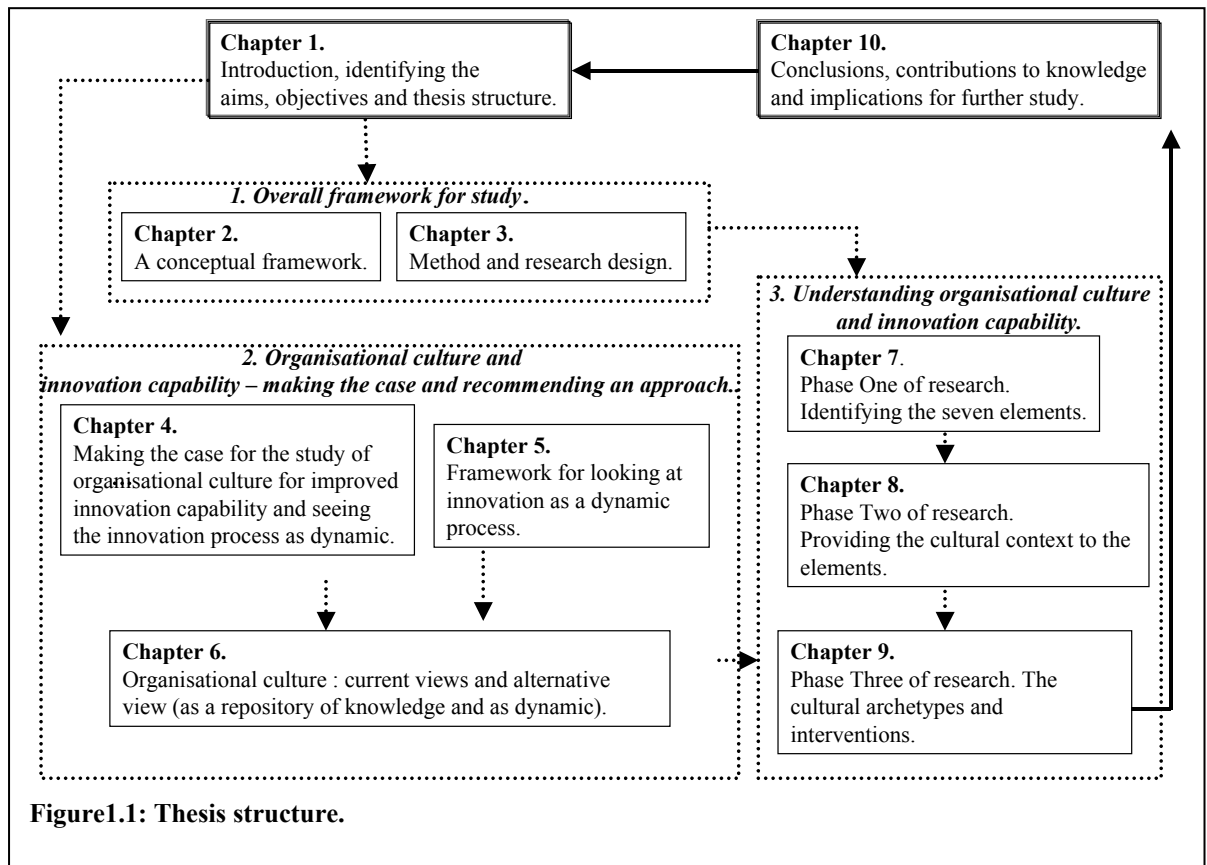
### **1.5 The contribution to knowledge.**

This thesis draws upon the broad literatures on knowledge management, organisational behaviour, organisational theory and systems thinking to explore the relationship between organisational culture and innovation capability within an R&D environment. It also considers the innovation process and organisational culture as dynamic and presents organisational culture as a repository of knowledge with knowledge being located in organisational layers. The location, attributes and characteristics of these repositories are provisionally identified and mapped. Various combinations of the properties of knowledge and their location are referred to as the knowledge dynamics of organisational culture. Four cultural archetypes with specific knowledge dynamics are developed through a three-phase research strategy which advances a clearer understanding of the relationship between organisational culture and innovation capability. These are the conceptual models of organisational culture which are then used to suggest strategies for improving innovation capability through the effective and appropriate movement between them. Culture is considered as contextual and dynamic and develops during the course of interaction with its environment and therefore shapes and reshapes its knowledge dynamics in response to that. This is a key determinant of innovation capability and should be continuous and aligned to the various indicators for creating competitive advantage. The contention throughout this study is that knowledge is culturally determined and that by recognising organisational culture as an entity with an identity that is reflected in its knowledge dynamics, strategies of intervention based on perceptions of the environment, and a learning approach can provide organisations with a dynamic capability for adaptability. Organisational culture must be able to consciously transform itself in response to its context and this can be a source of sustained innovation capability. The theoretical and substantive contributions are discussed in more detail in Chapter Ten of this thesis.

### **1.6 Thesis structure.**

The final section of this chapter looks at the thesis structure. Figure 1.1 is organised in three sections and depicts this and the sequence in which it is applied and studied

1. Section One – *the overall framework for study*. Chapter One (which described the Exploratory Phase of research) links directly to this section and consists of Chapters Two and Three. Chapter Two develops the conceptual framework of the study, while Chapter Three presents the research design and strategy. This section also links to Section Three which is headed “understanding organisational culture and innovation capability” and addresses the three phases of the research.



2. Section Two - *organisational culture and innovation capability – making the case and recommending an approach*. Chapter One also links with this section, which consists of Chapters Four, Five and Six. Chapter Four makes the case for considering organisational culture as an important factor affecting innovation capability and for considering the innovation process as dynamic. Chapter Five then examines alternative literatures that provide a framework for looking at innovation as a dynamic process. Both these chapters link to Chapter Six, which first looks at the current literature, views and models on organisational culture and then presents an alternative view of looking at organisational culture as a repository of knowledge. A cultural knowledge

matrix is developed next which helps to locate and identify the knowledge dynamics of the four cultural archetypes developed in Chapter Nine.

3. Section Three - *understanding organisational culture and innovation capability*. Both Sections One and Two link into this section, which covers the three phases of the research. Chapter Seven is Phase One of the research and addresses the first objective of the study. Through semi-structured interviews seven elements that affect innovation capability are identified. Synthesising the seven elements with the conceptual framework presented in Chapter Two an initial conceptual model of organisational culture is then developed. Phase Two (Chapter Eight) addresses the second objective of the study as outlined in under section 1.4.3 which is to provide a broader cultural context for these elements. Six distinctive configurations of cultural characteristics *cultural dimensions* are identified from secondary sources and then analysed in terms of the elements. Phase Three (Chapter Nine) addresses the third and fourth objectives of the study. Further semi-structured interviews are carried out and four cultural archetypes (cultural classifications) that are generic models of organisational culture as they relate to innovation capability are developed. The chapter also identifies their knowledge dynamics and locates that knowledge using the cultural knowledge matrix. Intervention strategies that can facilitate the movement between archetypes are presented next.

Chapter Ten discusses and concludes the study. It summarises what has been achieved and links back to the aims and objectives of Chapter One. It evaluates the substantive findings and contributions to knowledge, evaluates the conceptual framework, appraises the chosen research method and finally presents the implications for further study.

A section of the thesis structure is presented at the beginning of each chapter for the purpose of locating it in relation to the rest of the thesis.

### **1.7 Conclusions to the chapter.**

The importance of organisational innovations to the knowledge economy and the concept of organisational culture that continues to strike managers and management-oriented writers as a key variable in its success or failure were introduced in this chapter and some concerns in its study outlined. The INTA/BT study which provided the background to this study, a set of initial issues of interest and broad aims and



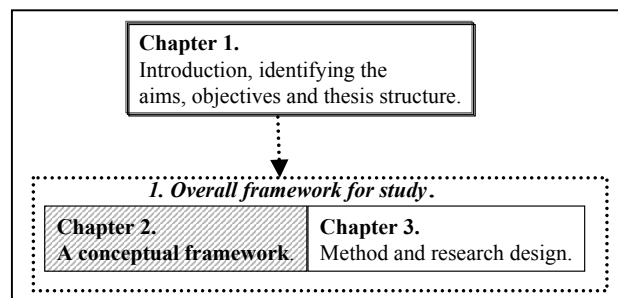
objectives were presented next. The Exploratory Phase of research was described subsequently the outcome of which was the identification of four substantive issues, the identification of the six research domains that would be the focus of this study and the development of the conceptual framework. These then resulted in the identification of a specific research aim, a set of research objectives and the recommendation of a multi-method approach to the study. A brief description of the literatures that would help inform this study and the thesis structure were presented next.

The next chapter develops the conceptual framework and locates the six domains through a step-by-step process. The chapter concludes by presenting literatures relating to the conceptual framework.

## Chapter 2. A conceptual framework.

### 2.1 General introduction and purpose of chapter.

The purpose of this chapter is to expand on Section 1.4.2 of the Exploratory Phase of research and describe both the interactive process of developing the conceptual framework and its implications to this study. This chapter is also the first of the two chapters under Section One of the thesis structure.



Three main criteria (technological trajectories and core competencies, strategy, and the complexity of the environment) are seen by managers as determining the innovation capability of the organisation and are used to identify six research domains that would be the focus of this study. Using these three criteria a conceptual framework is developed through a step-by-step interactive process involving senior managers of BT and the domains located on it. Their positions on the conceptual framework highlight the cultural differences between them and a discussion on this is presented. The chapter then presents literatures relating to the conceptual framework.

### 2.2 Identifying the research domains.

The identification of the research domains within the BT research community that would form the core focus of this investigation and study was the first step in constructing the conceptual framework.

The following criteria were considered to be representative of the research community and were used to identify six domains of research.

1. Technological trajectories and core competencies. Were the research domains focusing on past competencies (e.g. traditional product lines such as telephony), developing new competencies (internet products, wireless products etc), or working in areas of unexplored technologies? What was the history of the

research domain (was it a new enterprise, or was it a domain with a strong background from BT's past civil service culture)? Where did it fit on the organisational time line in terms of its evolution?

2. Strategic focus. Was the domain focused on short term or long-term (for example blue sky) research?
3. Environmental perceptions. How was the organisational environment in terms of innovation activity perceived by the domain managers – high or low complexity?

The literatures relating to these three criteria are explored in Section 2.4 and the domains identified were as follows.

#### **Domain “A” - Management.**

Interviews would be conducted with two senior managers from this domain. One of them was located on site at Adastral Park and working in the Corporate Office with responsibility for the financing and setting of the strategic direction for the research agenda. He had extensive experience of working as a project manager in a research unit and was familiar with the innovation process from the grassroots level. The second manager was based more than one hundred and fifty miles from the research site and was responsible for *“innovation, creativity and leadership”*. His role was seen as an integrative one, making connections between people, ideas and networks, including communities of practice both inside and outside of the company.

#### **Domain “B” - Business Modelling Unit (strategic tools).**

This was a small department that was concerned with both current issues and problems and identifying and developing new techniques and approaches. It carried out modelling work with new areas of technology in order to develop improved solutions for its customers, the majority of whom were located within the company.

#### **Domain “C” – Advanced Multimedia (old unit providing new services).**

The main research focus of this group involved the integration of a variety of technologies in order to identify new potential applications. It was important for this group to produce a tangible output whether that was in the form of a product for a market, a demonstrator or a prototype. It then ‘migrated’ the product to explore how the organisation could get added value from it. As demand changed the unit started to look not just at the technology but also at the business context in which it was likely to be used. The group saw itself sandwiched between long-term research and the organisation's

short-term development activities, which were focused on multimedia and clearly oriented to meeting its short-term goals. This was an uncomfortable position because the group, and individuals within it, saw their role as being ‘maverick’ and challenging the existing order.

**Domain “D” – Brightstar (exploitation).**

This group was set up in response to concerns that the organisation was not achieving synergy between its parts with the result that the potential value of its innovation activities was never fully explored. (Innovation in this thesis is described as the conscious ‘creation’ of something new or the conscious reformulation and use of something that is already in situ and this process encapsulates invention (e.g. new technologies) and adaptation (e.g. of those technologies or organisational structures and procedures)). There was a perceived need by the management to create an entrepreneurial culture that was not present within the organisation’s traditional R&D model. The group saw itself as an incubation unit for down streaming innovations and enhancing and facilitating value creation through joint ventures or spin offs.

**Domain “E” - Business, Technology Futures, BT Internet and Multimedia Application (new services).**

This unit carried out advanced research activities in e-commerce and saw itself as “coupling” and bridging the gap between on the one hand the researchers in this area and on the other business development. It felt that it had achieved more synergy with the business end of the organisation than most of the other research units. The focus for the group was on the exploitation of current capabilities within this specific context.

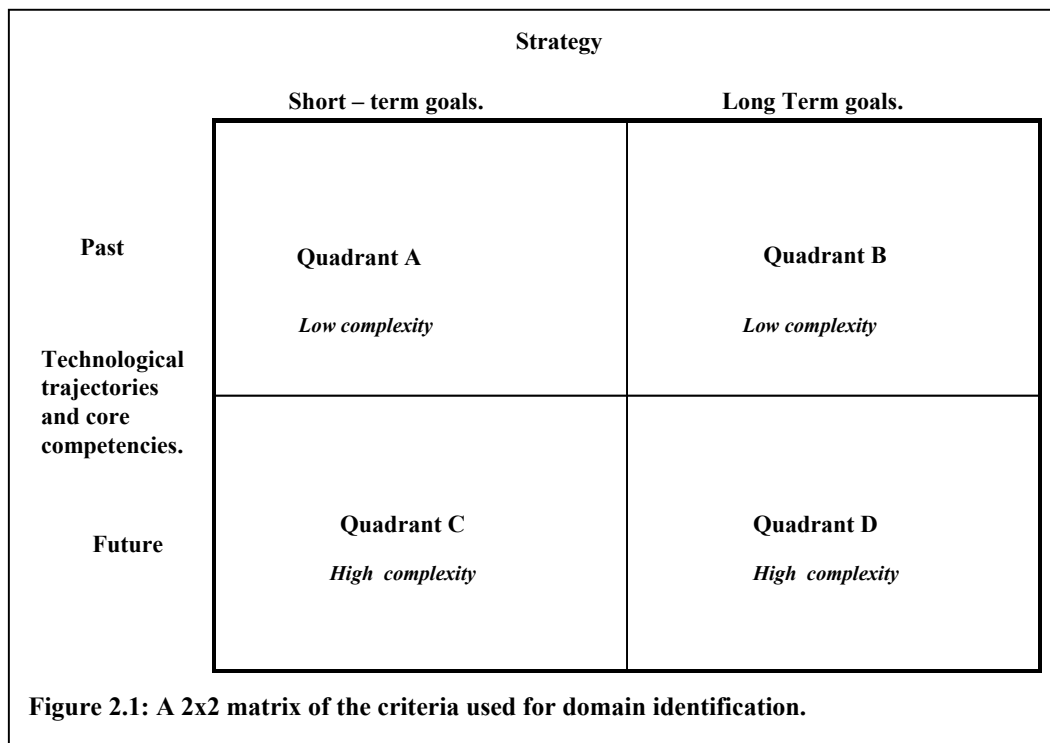
**Domain “F”- Next Generation Internet Research (new services).**

The focus of this group was on the exploration of future scenarios in next generation Internet research. Research was concentrated in twelve specified technologies with the aim of becoming a leader rather than a follower in the market.

### **2.3 The conceptual framework.**

The three criteria discussed above were depicted on a 2x2 matrix and then considered in terms of each research domain (Figure 2.1).

Quadrant A depicts an area of research that is focused on short-term business goals while concentrating on past technological trajectories and competencies. This would include areas such as the traditional BT telephony services.



This quadrant is also perceived as low risk. These perceptions can be attributed to the fact that the managers working in this quadrant are operating using current and past technological trajectories and competencies contributing to well-known short-term goals usually in established markets.

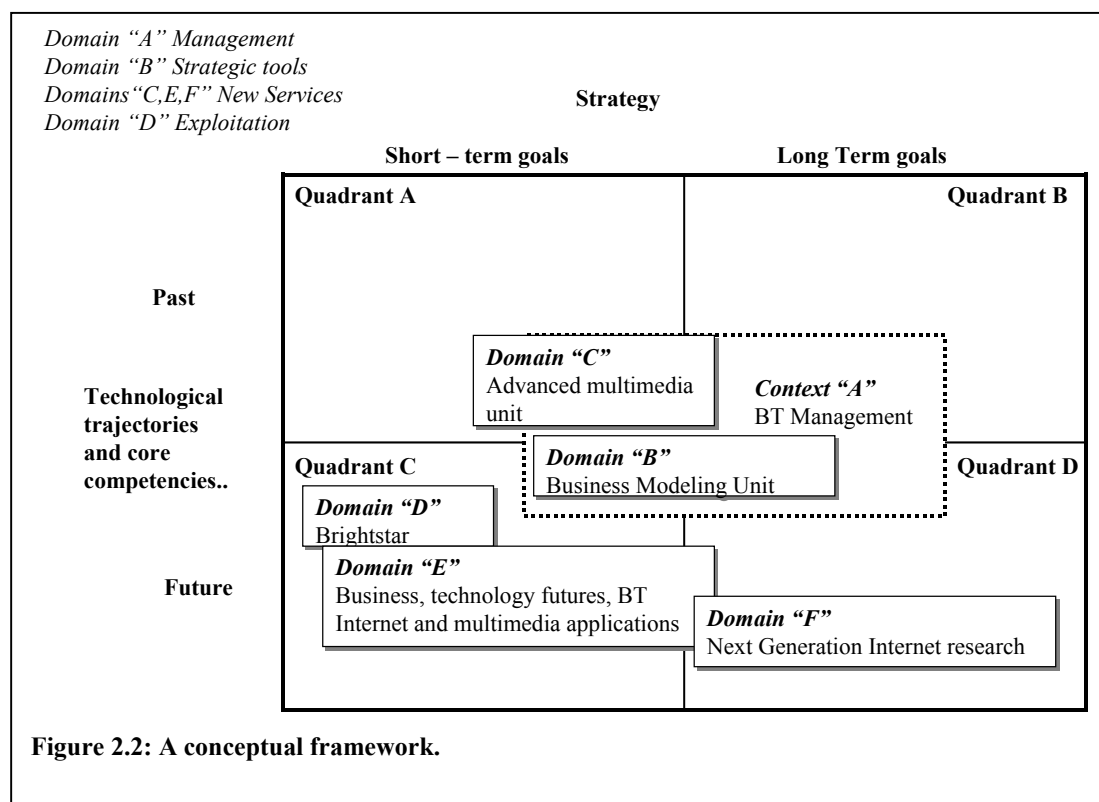
Quadrant B depicts an area of research where the focus of research is still on past technological trajectories but focusing on long-term research type of projects. This would include such areas as improvements to the traditional BT line products and services for example in providing the 1471 (which gives the identity of the last caller) or 1571 (which provides messaging services) on our telephones. As in quadrant A, this quadrant operates in a low complexity environment as it is still working in areas of established technological trajectories and competencies but with a focus on the long term.

Quadrant C depicts an area where the focus of research is on developing future technological trajectories and competencies while at the same time staying focused on the short-term goals of the organisation. An example of this would be the creation of spin off companies or establishing joint ventures to realise short-term value creation for the organisation. The creation of multi-media and on-line auction products are other

examples. The managers in this quadrant perceive their environment as high complexity and have to develop future technological trajectories and competencies to meet pressing pressures to meet short-term goals of the organisation.

Quadrant D focuses on an area of research that addresses the future technological trajectories of the organisation while at the same time staying focused on the long-term goals of the organisation. This would include such areas as the development of new technologies, with or without current applications to enable the organisation to develop new products in the future. The environment of this quadrant is perceived as high complexity and the technological trajectories and competencies need to be developed at an accelerated pace to meet these long-term goals. These goals can usually be ambiguous and subject to constant review and change.

Figure 2.1 was then developed further into the conceptual framework to reflect the positions of the six research domains on the matrix and to indicate their positions in relation to one another (see Figure 2.2).



A discussion of this conceptual framework and organisational culture is presented next

### **2.3.1 The conceptual framework and organisational culture.**

The conceptual framework identified and differentiated the six research domains. The interpretation of the different positions highlighted examples of cultural variation between the domains and although the three criteria helped the development of the conceptual framework for looking at the organisation's innovative capability, it became evident that a key component that differentiated between contexts, however, was not represented in this framework. The cultures that were evident within the organisation and helped to determine it as a whole had to be more clearly understood and this forms the central focus of this thesis.

Most organisational scholars and observers now recognise that organisational culture has a powerful effect on the performance and the long-term effectiveness of organisations. Culture has been defined in many ways. Kluckhohn (1951) quotes as a consensus of anthropological definitions:

*Culture consists in patterned ways of thinking, feeling and reacting, acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiments in artefacts; the essential core of culture consists of traditional (i.e. historically derived and selected) ideas and especially their attached values (pp 86).*

This thesis considers knowledge to be culturally determined and conceptualises culture as a repository of knowledge. It also considers the knowledge dynamics of organisational culture as an important characteristic that can give organisations the dynamic capability to meet challenges in its environment. The conceptual framework provides an overarching framework for developing the conceptual model of organisational culture as it relates to innovation capability and is developed incrementally in Section Three through a three-stage phase. Further literatures on organisational culture are examined in Chapters Six.

## **2.4 Exploring the literatures relating to the conceptual framework.**

The literatures relating to the three categories that define the research activity and focus of the six research domains and are reflected in the conceptual framework are introduced in the following section.

### **2.4.1 Technological trajectories and core competencies.**

Teece and Pisano (1994) have shown that firms' strategies are path dependent, i.e. they are strongly constrained by their current position and by the specific opportunities open

to them in the future. At any point in time, two sets of constraints make path dependency in corporate innovation strategy inevitable, the present and future state of technological knowledge, and the limits of corporate cognition or what specific firms are capable of learning and exploiting.

	Supplier dominated	Scale-intensive	Information intensive	Science based	Specialized suppliers
Typical core sectors	Agricultural Services Traditional manufacture	Bulk materials Automobiles Civil Engineering	Finance Retailing Publishing Travel	Electronics Chemicals	Machinery Instruments Software
Main sources of technology	Suppliers Production learning	Production engineering Production learning Design offices Specialized suppliers	Software and systems departments Specialized suppliers	R&D Basic research	Design Advanced users
Main tasks of technology strategy	Use technology from elsewhere to strengthen other competitive advantages	Incremental integration of changes in complex systems Diffusion of best design and production practice	Design and operation of complex information processing systems Development of related products	Explore basic science Development of related products Obtain complementary assets Redraw divisional boundaries	Monitor advanced user needs Integrate new technology incrementally

**Table 2.1: Five major technological trajectories (adapted from Tidd *et. al.* 1997).**

From the idea of path dependency emerged the notion of technological trajectories. Firms are constrained in their choice of innovation strategies by their accumulated skills and by the opportunities they are capable of pursuing i.e. they follow *technological trajectories*. The ability of an organisation to track and exploit these trajectories was first proposed by Nelson and Winter (1977) and later explored by Dosi (1982) and depends on their specific technological and organisational competencies. Pavitt (1984) developed a framework for integrating changing technology into strategic analysis that deals effectively with corporate and sectoral diversity. Other studies have shown consistent differences amongst industrial sectors in the sources and directions of technological change (Tidd *et.al.* 1997). These were summarized as follows: size of innovating firms, type of product made, objectives of innovation, sources of innovation and locus of own



innovation. Tidd *et al.* (1997) distinguished five major technological trajectories, each with its distinctive nature and sources of innovation and implications for technology strategy and innovation management. These are summarized in Table 2.1. The case material for this study falls in the “science- based” technological trajectory where technological accumulation emerges mainly from corporate R&D laboratories and is heavily dependent on knowledge, skills and techniques emerging from academic research.

Findings from this research and recent literature show a changing trend to wider networking within and out of core organisational boundaries. This takes the shape of either buying-in technology, collaboration with competitors, joint ventures or spinning out into specialized technology (and product) business units. Chemicals and electronics are core sectors, however fundamental discoveries open up new product markets. Technological accumulation in the firm is through horizontal search for new product markets over a wide range of potential applications. The main tasks of technology strategy are to monitor and exploit advances emerging from basic research. It is also responsible for the development of technologically related products and the acquisition of the complementary assets (e.g. production and marketing) to exploit them, and the reconfiguration of operating divisions and business units in the light of changing technological and market opportunities. Knowledge of these technological competencies can improve analysis of particular companies’ technological strategies (Tidd *et al.* 1997). The ability to track and exploit technological trajectories depends on their specific technological and organisational competencies, and on the difficulties that competitors have in imitating them. Dosi *et al.* (1992) have shown that the notion of firm-specific competencies has increasingly become influential amongst economists trying to explain why firms are different, and how they change over time. Hall (1994) goes some way towards identifying and measuring *core competencies*. He distinguishes between intangible assets and intangible competencies. Assets include intellectual property rights and reputation. Competencies include the skills and know-how of employees, suppliers and distributors and the collective attributes, which constitute organisational culture. Hall’s empirical work indicates that managers believe that the most significant of these intangible resources are company reputation and employee know-how, both of which may be a function of organisational culture. Thus organisational culture, defined as the

shared values and beliefs of members of an organisational unit, and the associated artefacts becomes central to organisational learning (Hall, 1994). Hamel and Prahalad (1990) summarize their basic ideas on core competencies as:

1. The sustainable competitive advantage of firms resides not in their products but in their core competencies:

*“the real sources of competitive advantage are to be found in the management’s ability to consolidate corporate wide technologies and production skills into competencies that empower individual businesses to adapt quickly to changing opportunities”(p.81).*

2. Feeding into more than one core product, which in turn feed into more than one business unit. They use the metaphor of the tree where the core competencies are the roots, core products are the trunk and major limbs, the business units are the smaller branches with the end products being the leaves, flowers and fruit.

3. The recognition of the importance of associated organisational competencies.

*“core competence is communication, involvement, and a deep commitment to working across organisational boundaries”( p.82).*

4. Requiring focus on a few competencies.

*“Few companies are likely to build world leadership in more than five or six fundamental competencies. A company that compiles a list of 20 to 30 capabilities has probably not produced a list of core competencies” ( p.84).*

The notion of core competencies suggests that large and multidivisional firms should be viewed not only as a collection of strategic business units (SBU) but also as bundles of competencies that do not necessarily fit tidily into one business unit. This is certainly true of BT.

5. The identification and development of a firm’s core capabilities depends on its strategic structure, defined as

*“ ... a road map of the future that identifies core competencies to build and their constituent technologies...should make resource allocation priorities transparent to the whole organisation...Top management must add value by enunciating the strategic architecture that guides the competence acquisition process” (p. 89).*

The approach by Hamel and Prahalad (1990) places the cumulative development of firm-specific technological competencies at the centre of the corporate strategy agenda (Tidd *et.al.* 1977). It reflects what has been happening in successful firms in science-based industries. The competence-based view of the corporation has major implications for the organisation of R&D and for methods of resource allocation and for strategy

determination (Graham, 1986; Hounshell and Smith, 1988; Reader, 1975; Reich, 1985). It is not clear, however, that corporate core competencies in all industries offer a basis for product diversification. Recent historical experience of most steel and textile firms, where product diversification is based on existing technological competence, indicates technology related product diversification to be quite difficult (Tidd, *et al.* 1977). Large firms achieve a distinctive world beating position although they may be typically active in a wide range of technologies (Patel and Pavitt, 1997). In other technological fields, a *background* competence is necessary to enable the firm to benefit from outside linkages. In industries with complex products or production processes a high proportion of a firm's technological capabilities is deployed in such background competencies (Prencipe, 1997). Firms are also constrained to develop competencies in an increasing range of technological fields in order to remain competitive, as products become more "multi technological" (Tidd *et.al.* 1997). They cite the example of Ericsson and trace the accumulation of their technological competencies with successive generations of mobile cellular phones and telecommunications cables. In both cases, each generation required competencies in a wider range of technological fields, and very few established competencies were made obsolete. This process of accumulation involved both increasing links with outside sources of knowledge, and greater expenditure on R&D, given greater product complexity. This was not a process of concentration but of diversification in both technology and product. Tidd *et.al* (1997) suggest that the notion of "core competencies" should be replaced for technology by "distributed competencies" given that in large firms they are distributed over a large number of technical fields; over a variety of locations within the corporation (in R&D, production engineering and purchasing departments of various divisions and in the corporate laboratory) and amongst different strategic objectives of the corporation.

Dorothy Leonard Barton (1995) has pointed out that core competencies can also become core rigidities when established competencies become too dominant. As a result important new competencies may be neglected or underestimated. Many examples show that when core rigidities become firmly entrenched their removal often requires changes in top management.

### 2.4.2 Strategy.

Pascale *et al.* (1981) include “strategy” and “super-ordinate goals” as two of their “seven-S’s” approach. The other five “S”s are discussed later in Chapter Seven which deals with the elements that affect innovation capability. West *et al.* (1990) cite Meyer’s (1982) findings that ideology and strategies exert strong forces guiding organisational adoption. The presence of an effective plan can act as a beacon to guide the organisation during the turmoil of change process (Dooley, 1997). Such a strategic plan is a concise document that clearly defines the strategies and the desired vision to be pursued by an organisation. This plan should be readily accessible to all the organisation’s employees so that they can correlate their idea generation and problem-solving activities to current and future goals. Irrespective of the planned versus emergent perspectives of strategic planning there are advantages to defining broad strategic thrusts for the organisation. This allows the organisation to correlate its ongoing innovation initiative relative to the broad direction it wishes to progress and to motivate employees to move the organisation towards these goals. One of the main findings of the AMBITE software tool project (Advanced Manufacturing Business Implementation Tool for Europe BE 7049) highlights the benefits of a framework that allows the translation of business goals into a set of operational level activities. The aim of the software was to determine the justification and effects of new technology investments within the manufacturing function of an organisation. The types of programmes and technologies to be addressed included: Concurrent Engineering (CE), Lean Manufacturing (LM), advanced electronics and assembly technology such as Chip on Board (COB) and Multi Chip Modules (MCM). The project’s overall objectives were:

1. To accelerate the take up of new manufacturing technologies by helping senior managers and decision makers to understand the medium and long term implications of implementing such technologies.
2. To provide such decision makers with an approach and the necessary tools, which will allow them to evaluate in detail the impact of such technologies on business metrics.

The identification of these measures provides a means of aligning ongoing actions with the goals. Strategic management provides an important link between the organisation and its environment through which information and influence pass.

Tidd *et al.* (1997) concluded that the most useful framework developed so far for strategic innovation was by Teece and Pisano. This is generally referred to as the dynamic capabilities approach and is discussed in more detail Chapter Five.

Successful strategies are dependent on the organisation having the *strategic capability* to perform at the level, which is required for success. Strategic capability can be related to three main factors: the resources available to the organisation; the competence with which the activities of the organisation are undertaken; and the balance of resources, activities and business units in the organisation (Johnson and Scholes, 1997).

Analysing the strategic capability of an organisation is clearly important in terms of understanding whether the resources and competencies *fit* the environment in which the organisation is operating, and the opportunities and threats, which exist.

One such tool for strategic analysis is referred to as the SWOT (strengths, weaknesses, opportunities and threats) framework. The application of this framework was made popular by Ken Andrews of the Harvard Business School in the mid 1960s, and has been dominated by Michael Porter's "five forces" model. This focuses on the external side of the strategic balancing act, helping firms understand those forces in industry that give rise to opportunities and threats. The five forces are:

1. The bargaining power of customers.
2. The bargaining power of the suppliers.
3. The threat of new entrants.
4. The threat of substitute products.
5. The strength and nature of traditional rivalry among firms in the industry.

Industries structured so as to enable firms to dictate terms to its suppliers and customers and provide barriers to new entrants and substitute products are seen as favourable. Strategy becomes a matter of choosing an appropriate industry and positioning the firm in that industry according to a generic strategy of either low cost or product differentiation (Porter 1985). According to him, firms must also decide between two market strategies:

1. Innovation "leadership" – where firms aim at being the first to market, based on technological leadership. This requires a strong corporate commitment to creativity and risk taking, with close linkages both to major sources of relevant new knowledge, and to the needs and responses of customers.

2. Innovation “followship” – where firms aim at being late to market, based on imitating (learning) from the experience of technological leaders. This requires strong commitment to competitor analysis and intelligence, to reverse engineering and to cost cutting and learning in manufacturing.

The following example from interview data presented in Chapter Seven shows that certain domains of study are innovation leaders while others are followers. The overall strength of the organisation lies in being an innovation follower, its biggest competence being the speed of mobilization of its resources. This is suggested by one of the managers interviewed at BT.

*“Let us take this broadband thing we are running out at the moment (ADSL). We are not the only ones in the market. We might be the only one in the UK, where there isn’t any real players, not big players there are a few small ones. In the USA people have been offering that service for a year or more, but BT has now embraced it, and is rolling it out at a speed with a coverage that is greater than what other companies have done. We sort of watched to see what was going on, maybe a year later, but now we are coming in and doing it at a bigger scale and more enthusiastically than our competitors are. Is that being a risk taker or not? I think it is not being a risk taker in the sense that first let others do and deal with the problems and sort out the teething problems, but we are a risk taker in the sense that we are doing it with a level of commitment that some of our competitors aren’t”. Manager Domain E.*

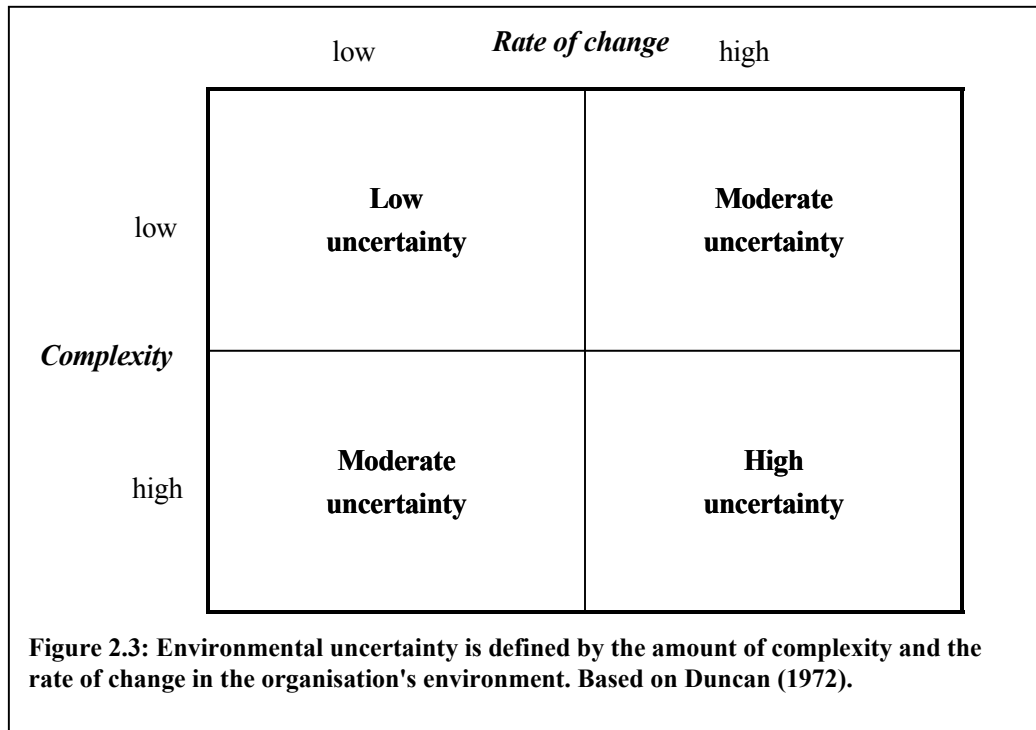
Porter’s framework, however underestimates the power of technological change to transform industrial structures, and overestimates the power of managers to decide and implement innovation strategies – it underestimates the importance of technological trajectories and of the firm specific technological and organisational competencies to exploit them (Tidd, 1997).

### **2.4.3 The environment - complexity, change and uncertainty.**

Uncertainty is considered to be a property of the environment resulting from two powerful forces: complexity and the rate of change. Complexity refers to the number and diversity of the elements in an environment and the rate of change refers to how rapidly these elements change.

Environmental uncertainty is defined as the interaction between varying amounts of complexity and change outside of the direct control of the organisation (definition of environment as that which is outside the system of interest/direct control) (Hatch, 1997). Environments do not feel uncertain but people do and they do not experience conditions in the same way (Hatch, 1997). Duncan and Roberts (1972) have shown that what affects

organisations is not the environment so much as the perceptions of the organisation decision makers about how uncertain the environment is. See Figure 2.3.



Contemporary organisational theorists recognize that uncertainty lies not in the environment but in the individuals who consider the environment when they make organisational decisions. This viewpoint has come to become associated with the information perspective in organisation theory (Aldrich and Mindlin, 1978) which argues that managers feel uncertain when they perceive the environment to be unpredictable and this occurs when they lack the information they need to make sound decisions (see Figure 2.4). When managers perceive environments as stable and as having minimal complexity, they find that the information they need is both known and available, and as a result experience low levels of uncertainty (Hatch, 1997). When environments are perceived to have high complexity or to be rapidly changing, managers confront either too much information or the challenge of keeping up with changing information. In the case of high uncertainty, managers perceive a highly complex and changing environment and will face an overwhelming amount of information but they will not know which to attend to due to constantly changing circumstances.

Early efforts to explain how organisations respond to uncertainty relied on the concepts of requisite variety and isomorphism. The Law of Requisite Variety, which is borrowed from General Systems Theory, states that for one system to deal with another it must be of the same or greater complexity. In organisational terms this means that organisations map perceived environmental complexity with their internal structures and management systems.

		<i>Rate of change</i>	
		low	high
<i>Complexity</i>	low	<b>Needed information is known and available</b>	<b>Constant need for new information</b>
	high	<b>Information overload</b>	<b>Not known what information is needed</b>

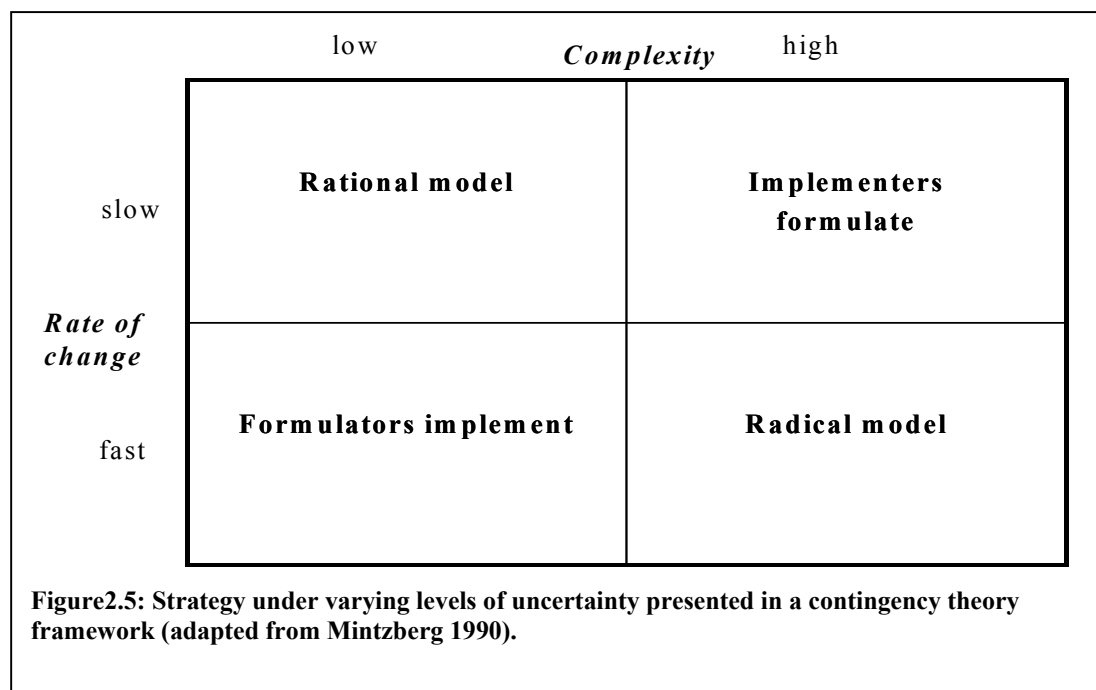
**Figure 2.4: Links between conditions in the perceived environment, uncertainty, and information (adapted from Hatch, 1997).**

Isomorphism refers to requisite variety and the belief that organisations match the complexity of the environment with internal structures and systems. For instance, if the environment is simple, the organisation will take a simple form. In a complex environment, the isomorphic organisation will also be complex. In changing conditions, the concepts of isomorphism and requisite variety suggest that organisations will change too. Lawrence and Lorsch (1967) suggest that organisations confront different conditions and elements in their environments. The different environmental demands create pressure for internal differentiation. Put in another way, differentiation allows different parts of an organisation to specialize in handling responses to different demands from the environment. It is this differentiation of the organisation into specialised units for confronting different aspects of the environment that produces the internal complexity of



structure and systems referred to by the concept of isomorphism. Scott (1992) suggests that buffering and boundary spanning are two examples of structural differentiation in response to uncertainty. Buffering involves protecting internal operations from interruption by environmental shocks such as material, labour, or capital shortages. Boundary spanning is the label given to environmental monitoring activities including the passing of required information. It describes the activity of representing the organisation or its interests to the environment.

Mintzberg (1990) uses contingency theory to provide a framework for deciding which perspective to apply to the innovation strategy process in organisations - see Figure 2.5.



An organisational strategist operating in the low uncertainty condition can easily comprehend the environmental forces that influence the organisation because the environment is perceived as relatively simple. Less pressure is also faced through the need to respond to change because the environment is stable within the managers' experience. These conditions are most favourable to the rational model and there is no difficulty formulating and communicating a strategy. As Mintzberg (1990) points out, however, strategies often operate under less than certain conditions.

In the case in which low environmental complexity coupled with rapid change is evident, a certain amount of uncertainty is perceived and a need to move quickly. Although things seem to be changing rapidly, they are not so complex as to overwhelm a manager's

ability to comprehend critical aspects of the situation and respond in an appropriate manner. The pressure that is felt comes in the form of time pressure. The fastest way to implement a strategy is to dispense with communication that takes time and risks misunderstanding. Mintzberg (1990) advises combining formulation and implementation into one single role in conditions of low complexity and rapid change.

In a stable environment that was complex, moderate uncertainty would be experienced, but the pressure felt by the manager would derive from incapacity to comprehend the critical aspects of the situation faced. This condition is frequently faced by organisations that rely heavily on expertise. As the environment demands a complex response that overwhelms the managers' capacity to comprehend what is going on it has to rely on others. Under these conditions Mintzberg recommends a collective strategy that involves those who would be considered as implementers within the rational model. Here the importance of an emergent perspective on the strategy process is highlighted. Through continuous interaction with other members of the staff strategy emerges from existing structures and processes in the context of continuous interaction.

High uncertainty is the most challenging environmental condition, and occurs in all organisations much of the time (especially those heavily involved in new technologies). Twin problems of incomprehensibility and severe time pressures are experienced. It becomes unclear what information is needed and it is difficult to amass the necessary information. The meaning of the information is also likely to be ambiguous and to make things worse action has to be taken regardless of the existence of a strategy or not. Mintzberg (1990) offers little help and suggests groping and coping until such time as things settle down and permit the re-establishment of a more rational strategy process.

## **2.5 Conclusions to the chapter.**

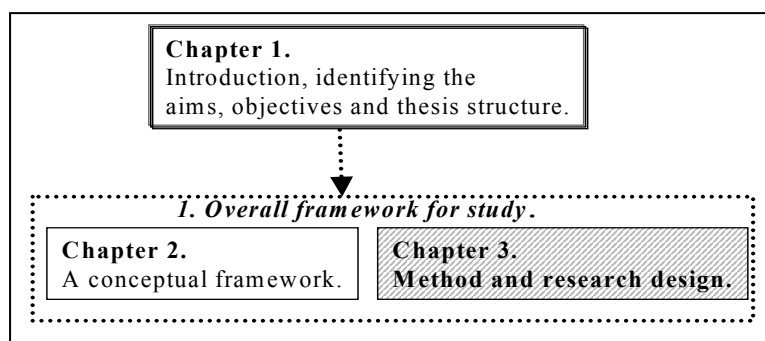
Three main criteria (technological trajectories and core competencies, strategy and the complexity of the environment) were used to identify six research domains and to develop the conceptual framework. From the position of the domains on the framework it became evident that a key component (cultures that were evident within the organisation and that differentiated between contexts) was not represented in this framework. This had to be more clearly understood. Literatures relating to the conceptual framework were presented next.

The next chapter looks at the research design.

## Chapter 3: Research design and fieldwork execution.

### 3.1 General introduction and purpose of chapter.

This chapter expands on section 1.4.4 of the Exploratory Phase of research presented in Chapter One and describes the research design and fieldwork execution.



Chapter One presented a specific research aim and a set of objectives. These would be achieved through the undertaking of a case study of innovation within an R&D context that would provide contextual data to help validate the cultural archetypes developed to understand and improve innovative capability. Chapter Two presented the conceptual framework that showed that the cultures that were evident within the organisation and helped to determine it as a whole had to be more clearly understood. The purpose of this chapter is to provide the research design that will be used for the fieldwork execution. The desire to maintain accessible, rich and disaggregated data, alongside comparative and aggregate measures necessitated a triangulated or multi-method approach to the fieldwork (Young and Mills, 1981; Burgess, 1984).

This chapter presents the elements within the multi-method approach that were undertaken to meet the fieldwork objectives. The *research design* established the plan and the sequence of the steps that would be implemented in the investigation and pursuit of these objectives, which were:

1. To define the research problem and formulate the aims and objectives of the study. The definition of the “problem” was highly contextual and subject to many viewpoints. In view of this it was necessary to undertake a phase of exploratory work to facilitate this. This was done through a series of meetings with the sponsors of the study and has been presented in Chapter One in section 1.4 in the Exploratory Phase of research.
2. To provide an understanding of the context within which innovation took place within BT and to identify the elements within organisational culture that affected innovation capability. This was done through semi-structured

interviews conducted with managers of the six research domains within the company.

3. To provide a broad cultural context to these elements by synthesising them with previous studies on organisational culture conducted by BT.
4. To identify the knowledge dynamics of the six domains in terms of their use of different types of knowledge. Further semi-structured interviews provided the data for this.
5. To validate and/or amend findings of various research phases through a series of interactive workshops.

The next section starts with a discussion on triangulation and provides the appropriate introduction to the choice of a multi-method approach.

### **3.2 Triangulation (multi-method).**

The danger of masking, or distorting factors in observing them has led to the use of multiple methods or triangulation. Abrahamson (1983) points out that this approach prevents the research becoming research-bound: the strength of almost every measure is flawed in some way or another, and therefore research designs and strategies can be offset by counterbalancing strengths from one another. Analogous to the navigational method of fixing ones position by reference to two, or more markers, a triangulation approach makes use of two or more research methods in an attempt to eliminate, or draw attention to these masking effects (Trott, 1993). The notion of triangulation has become a salient feature of research methodology (Denzin, 1970, 1978). He proposes four kinds of triangulation. The first is data triangulation, which has three subtypes: time, space and person - that is, data should be collected at a variety of times, in different locations and from a range of persons and collectivities. The second is investigator triangulation, which is using multiple rather than single observers of the same subject. Theory triangulation, the third type, consists of using more than one approach to generate categories of analysis. The fourth is methodological triangulation and has two subtypes: within method, for example in a questionnaire using a combination of attitude scales, forced choice items and open ended questions, and between-method triangulation, which is self-explanatory, and is probably the most important.

This project triangulates through qualitative research techniques that include content analysis (analysing texts and documents), semi-structured interviews, investigation of

the company Intranet and the use of interactive workshops. The analytical techniques for this research were drawn from those commonly applied in "soft complex" systems analysis and are described in Chapter Five.

### **3.2.1 A multi-method framework for understanding factors affecting innovative capability.**

One form of multi-method research approach is the naturalistic research method developed by symbolic interactionists (see Blumer, 1969; Perkins, 1988). A central feature of this approach is the process of "exploration" which effectively means that an enquiry starts from a broad beginning and sharpens as research proceeds (Perkins, 1988). Blumer (1969) has shown that the results of the exploration process are significant for two reasons. First, researchers develop an in-depth knowledge of the life-world of the group under study and secondly they are able to describe the meanings they ascribe to their life-worlds. It is crucial, therefore, for the fieldworker to have an empathy with the subject of the work. This empathy may well have a substantial and admirable grounding in the literature and theory surrounding the subject (Burgess, 1984), however, the language, relationships, physical environment can only be experienced. The need to acquire an understanding and a "feel" for the subject inevitably constrains the planning and design of fieldwork procedure, and by implication the formation of a rigid hypothesis. Lemon (1992) argues that if these hypotheses are set without empathy for the subject, it is possible that they will become "esteemed for" themselves and work as an absurd symbol of science. The danger is that the researcher may be unlikely to modify his or her hypothesis as his/her knowledge of the subject improves (Trott, 1993). The research therefore followed a flexible design firming-up as more data was collected and the understanding of the research issues developed. Agar (1981) outlines the practical problems of pursuing a research design without this "feel" for the subject. The researcher for instance, cannot specify the questions to be asked when moving into the community and does not know how to ask questions and specify a sample yet. The range of social types relevant to the topics the researcher is interested in is also not known. Agar may have exaggerated the case but the points are valid e.g. some basic questions may have been formulated but the language and procedure for asking them is dependent upon local knowledge. This is not to suggest that empathy and identity are one and the same, indeed, the value of the latter is the subject of much debate, especially in the area of participative research (Morgan, 1983).

The empathy or feel for the subject in this project was established through various methods. Firstly a historical analysis of documentation was carried out from within the organisation using internal reports and the company Intranet. Secondly a series of semi-structured interviews were undertaken with a variety of R&D managers within the organisation. The use of workshops was also instrumental in establishing this.

The multi-method approach was, therefore intended

1. to enable the structural variables to be seen within a cultural framework (Cicoural, 1964).
2. to reduce the difficulties in undertaking the fieldwork by establishing local contacts and being seen and accepted in the study environment.

### **3.3 Qualitative research.**

Mostyn (1985) points out a dilemma in the field of management research. Should research produce quantitative data with their apparent rigour, precision and reliability or should it focus on the more descriptive, phenomenological qualitative data, with its richness of detail and nuance. There are clearly strengths and weaknesses with both and the decision depends on the particular requirements of the research (Trott 1993). Mostyn (1985) outlines the findings of George (1959) who suggests that in certain circumstances quantitative analysis is not sensitive enough and the qualitative analysis of a limited number of crucial communications at one moment in time may often yield better clues to the particular intentions than more standardized quantitative methods.

Mostyn also argues that the quantitative analyst typically gives each unit or category of analysis equal weighting, which is totally unrealistic. Although qualitative analysis captures the richness, complexity, and gestalt of the material, quantitative methods, particularly those employing the use of a computer, are intolerant of ambiguity. One of the strengths of a qualitative approach is the ability to study participants closely so that the researcher is able to see the world from the respondents' view. This can provide a better understanding of the everyday experiences of managers within large organisations and at the same time can provide the researcher with a thorough understanding of the area under investigation (Trott, 1993).

#### **3.3.1 Qualitative interviewing.**

The term "qualitative interviewing" is usually intended to refer to in-depth, semi-structured or loosely structured forms of interviewing. Burgess (1984) calls them

“conversation with a purpose”. Generally, these types of interviews are characterised by:

1. A relatively informal style, for example with the appearance of a conversation or discussion rather than a formal question and answer format.
2. A thematic, topic-centered, biographical or narrative approach, for example where the researcher does not have a structured list of questions, but does usually have a range of topics, themes or issues which s/he wishes to cover.
3. The assumption that data are generated via the interaction, because either the interviewee(s), or the interaction itself, are the data sources. Qualitative interviews may involve one to one interactions, or larger groups (Mason, 1996).

The three main sources of data with which qualitative research is associated are: participant observation, unstructured and semi-structured interviewing and content analysis.

Zeweig (in Burgess, 1984) indicates that this style of interview (unstructured) cannot be started without detailed knowledge and preparation. He recommends that it is essential to observe people before a detailed conversation can occur (Burgess, 1984). Within this study it was the intention to use unstructured interviews and the observations about the environment in which they took place as the basis of this preparation and background knowledge. An initial attempt was made to guide the discussions along specific lines, e.g. company policy on risk taking, resources allocations etc. affecting innovation outcomes. Over time the intended informality was achieved and information disclosed and specific questions were asked, when supportive information was required.

One other purpose of the unstructured interviews was to establish a number of thematic indices that were likely to occur in subsequent fieldwork.

Fifty-two hours of interviews were obtained and selectively transcribed. Phase One involved twenty-four interviews and Phase Three an additional fourteen. The need to be selective was essential because the time required for transcription and analysis can be twelve times the length of an interview (Burgess *et al.*, 1988) and is obviously an important consideration in the choice of interviewing technique. The taped interviews provided a record and guide to content that removed the need for excessive and disruptive note taking. A notated outline of each interview was made to allow cross-

referencing with the recordings. Written notes were also made of comments received from managers at the interactive workshops.

### **3.3.2 Choice of semi-structured interview.**

For any meaningful research it is important to understand the organisation as a whole. Learning about what an organisation does and the way the people within that organisation work is an important aspect of any internal organisational study. This involves some form of engagement within the organisation in order to firstly become accustomed to the research context and secondly to build trusting relationships with the people within the organisation. Marshall and Rossman (1989) suggest an historical analysis as being particularly useful in qualitative studies for establishing a background prior to interviewing.

Gaining access to internal documents is normally extremely difficult for an external researcher. In this case, however, the organisation provided current records and confidential reports. The company Intranet (which required a log on password) provided a useful starting point to get a background on the organisation while at the same time providing very useful information on the research domains including profiles on the managers being interviewed. The sponsors were always ready to guide, and clarify any confusing issues or questions that arose.

Although it is useful to have background information, historical analysis has several weaknesses as a method used on its own.

*“Documents may be falsified deliberately and are subject to incorrect interpretations on the part of the recorder. Words and phrases used in old records may have different meanings---Errors in recordings as well as frauds, hoaxes, and forgeries pose problems in dealing with the past.” (Marshall and Rossman 1989, pp 96)*

While historical documented data can provide a view of the formal organisation, it cannot provide a “feel” of the informal organisational processes. For the purpose of this study, a semi-structured interview strategy was considered to be the most appropriate for uncovering and learning about these processes. The value of the interview as a research method is convincingly stated by Brenner *et al* (1985) who suggest that as long as 1942 Allport pointed out that the best way of finding out something about people’s activities was to ask them.

Semi structured interviews fall between the categories of structured and unstructured interviews. Structured interviews occur when the interviewer is not allowed to deviate from the wording of the questions, nor the order in which they are asked. The aim is



to standardise the experience so that variations in the answers given reflect real variations. Less structured interviews do not impose a rigid format on the interviewer, although there will almost certainly be a checklist of topics to be covered. The interviewer may thus decide the order in which the questions can be asked, and indeed may modify the questions themselves to suit the flow of the interview. The questions are also likely to be more open ended than those used in structured interviews. The aim is to make the interviewee feel as comfortable as possible and the lack of structure allows the interviewer to respond to the answers given by the respondent. In semi-structured interviews the questions are not set down in detail beforehand, thus allowing the interview to proceed in a naturalistic way. The interview will focus on certain predetermined topics but without preset questions. Alternatively it might be that some questions will be preset, especially those relating to the social characteristics of the interviewee, which the researcher has deemed to have significant variables. This allows for consideration of the way responses might vary according to these social characteristics, whilst ensuring that the overall sample is representative of the population to be studied in respect to the social variables identified.

The semi-structured interview has a number of strengths as a method of data collection. The most important of these is that it allows both parties to explore the meanings of the questions and answers involved. Any misunderstanding on the part of the interviewer or interviewee can be checked immediately in a way that is not possible when questionnaires are being completed or highly structured interviews taken. In addition the interviewee can give rapid, immediate responses. There are however a few characteristics for consideration that should not be ignored. This approach requires a variety of interpersonal skills on the part of the researcher. A considerable amount of time is also needed to design the interview schedule. Another characteristic to be considered is that because the contact between the interviewee and the respondent is face-to-face and may be intensive there is a likelihood that bias may develop. Some of this bias can be reduced through recording the interview and this was duly done in this study. It is also extremely difficult to conduct interviews with key decision makers in middle or senior management because of their busy schedules. A semi-structured interview approach was chosen for Phases One and Three of the study. The aim of the exploratory interviews in Phase One was intended to provide a preliminary understanding of the research community and the identification of seven elements affecting innovation capability. These provided the building blocks for an

initial conceptual model on organisational culture and a framework for the next phase of the research. The semi-structured interviews conducted in Phase Three also provided an in-depth understanding of the knowledge dynamics of the four cultural archetypes presented in Chapter Nine.

### **3.4 Content analysis.**

Content analysis has been associated with textual analysis since the 1600's when churches scoured newspapers for non-religious, even sacrilegious, content. It has since developed as a systematic, objective and quantitative methodology in a variety of disciplines for example in market research and psychoanalysis (Kassajian, 1977; Holsti, 1969; Weber, 1985). There is no necessity for the technique to be restricted to the output of mass-communication and they are equally applicable for the coding of open-ended questionnaires (see Chapter 9, Weber, 1985). What is common to various forms of content analysis is the identification of the meanings and signs that are communicated through different media or respondents.

The concepts of systemization and objectivity or reliability are based upon the establishment and maintenance of an explicit set of rules. This allows for the comparability of data and the systematic application of those rules as dictated by the investigator's theory (Holsti, 1969). Reliability is more concerned with the assessment techniques within that framework than with the validation of the study. The reliability of a simple word count may be complete and systematic but say nothing about the validity of the theoretical framework under study. Krippendorff (1980) suggests that whereas reliability assures that the analysis represents something real, validity assures that the analytical results represent what they claim to represent.

There are three distinct types of reliability.

1. Stability is merely the ability of one observer to consistently code and interpret the same data set at different times. It says little about the interpretive qualities of the coder or reliability of the categorizations.
2. Accuracy measurement requires the establishment of a standard against which the coders and the categorizations can be compared. Most qualitative data would not support such standards, although the interpretive procedure should be replicable.
3. The most common reliability test is that of reproducibility, by which intra and inter observer and category comparisons can be made.

The effective interpretation of qualitative data, therefore, relies upon maintaining the variety of responses and at the same time identifying common themes. The thematic analysis in turn is dependent upon the reliability of the aggregation data and the validity of that reduction. The former is a technical procedure to ensure that the aggregation is consistent and reproducible, the latter requires that the treatment of raw data is consistent with the theoretical premise of the study.

Internal company research reports concerning proposed new businesses restructuring provide an example where the issue of confidentiality was very important. Access to this data was taken as an indication of the high level of trust that had been established between the organisation and the researcher. Other company research reports examined included previous studies on organisational culture conducted by the organisation. Also examined were relevant research data and reports of joint studies carried out by Cranfield's INTA and BT and various sections of the company Intranet relevant to the lines of enquiry of this study.

### **3.5 Research strategy.**

The research design implemented a structured approach that was an inductive strategy with a divergent–convergent focus. This is now discussed in more detail next.

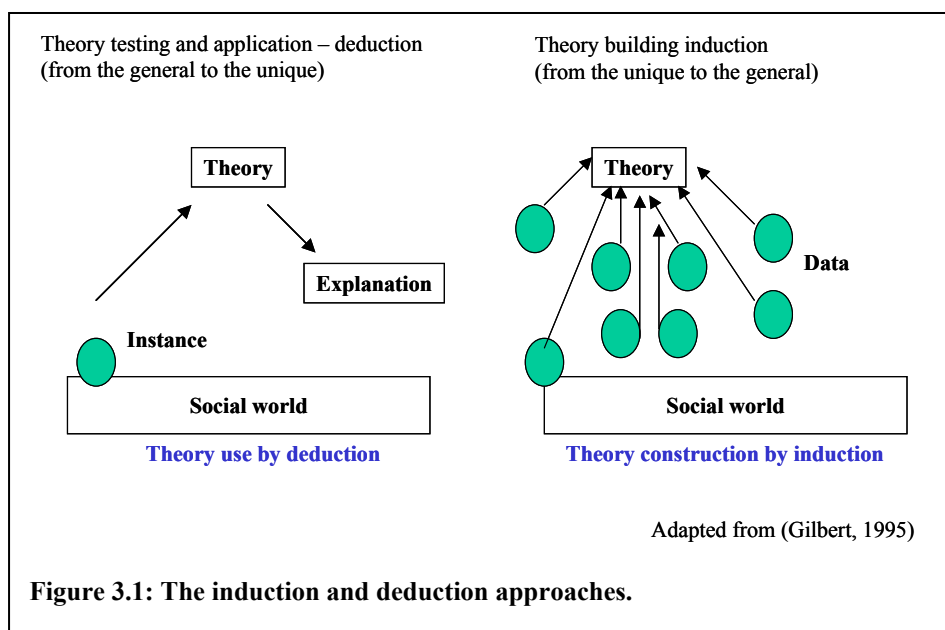
#### **3.5.1 The deductive – inductive approach.**

The distinction between deductive and inductive approaches is key to the choice of research method and central to arguments about 'scientific' validity. Induction is the approach for generating theories and deduction is the testing of them. Induction and deduction are distinct, yet in the course of research they are inevitably intertwined.

The process of finding a single case and observing a relationship, then observing the same relationship in several cases and finally constructing a general theory to cover all the cases, is known as induction (Gilbert, 1995). It is the basic technique for moving from a set of observations to a theory and is at the heart of sociological theory construction (see Figure 3.1).

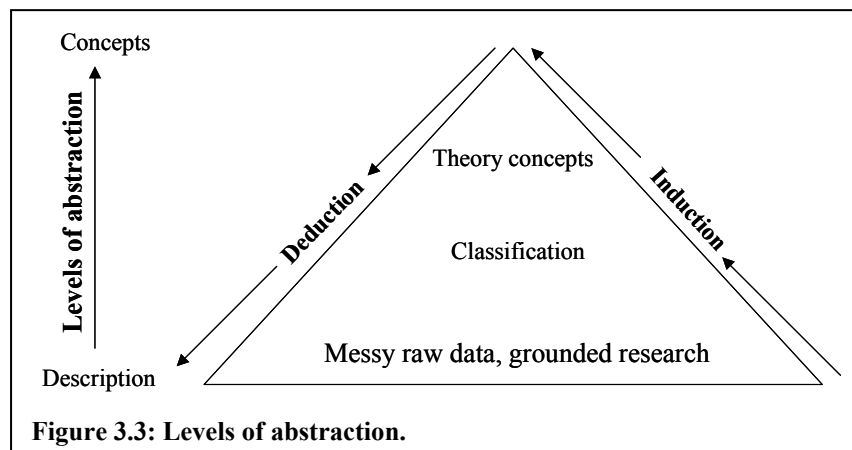
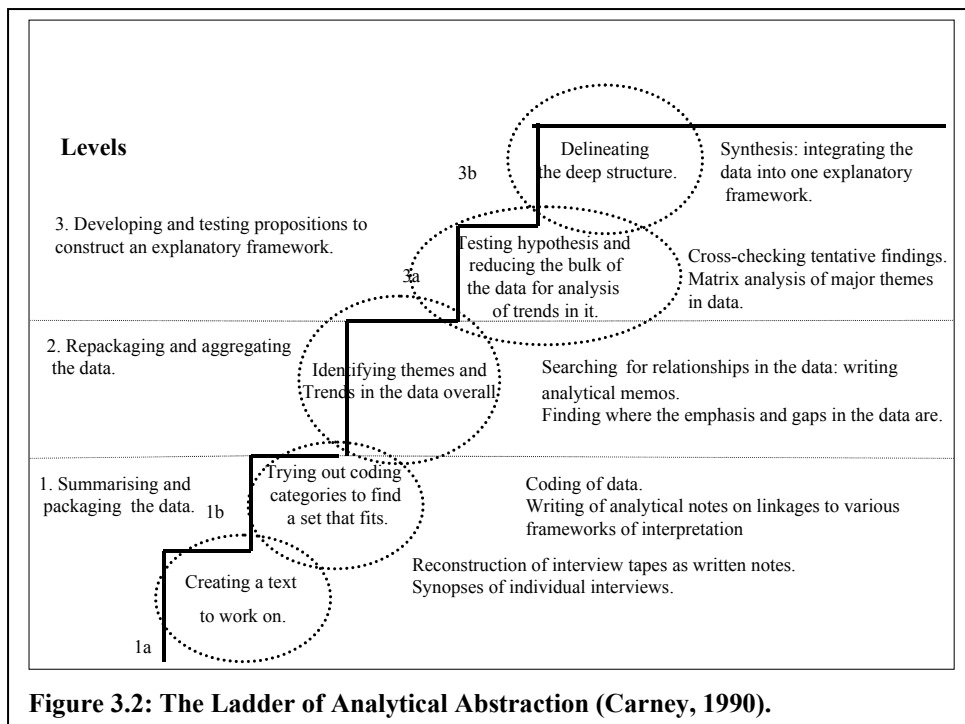
In an inductive strategy, all facts are observed and recorded without selection or guesses as to their relative importance. These are analysed, compared and classified without using hypotheses. From this analysis, generalisations are inductively drawn as to the relations between them (systemic thinking). These generalisations are subject to further testing (Blakie, 1993).

The process of starting with a theory and using it to explain particular observations is known as deduction. The pursuit of a deductive strategy (falsification) is guided by, and presupposes, theory. It is necessary to identify a hypothesis or hypotheses that form a theory or are generated by one. Conclusions can then be deduced about where the hypotheses are expected to hold true. This is followed by gathering appropriate data to test the conclusion (theory). If the data is not consistent with the theory it is false and must be rejected, if there is a match then the theory can be temporarily supported i.e. until the next test (Blakie, 1993).



Usually it is hard to explain something satisfactorily until you understand just what that something is (Miles and Huberman, 1994). Rein and Schon (1997) suggest a natural progression from a first “story” (what happened, and then what happened?) about a specified situation to constructing a “map” (formalising the elements of the story, locating key variables), to building a theory or model (how the variables are connected, how they influence each other). The progression is a sort of “ladder of abstraction” (Carney, 1990) - see Figure 3.2.

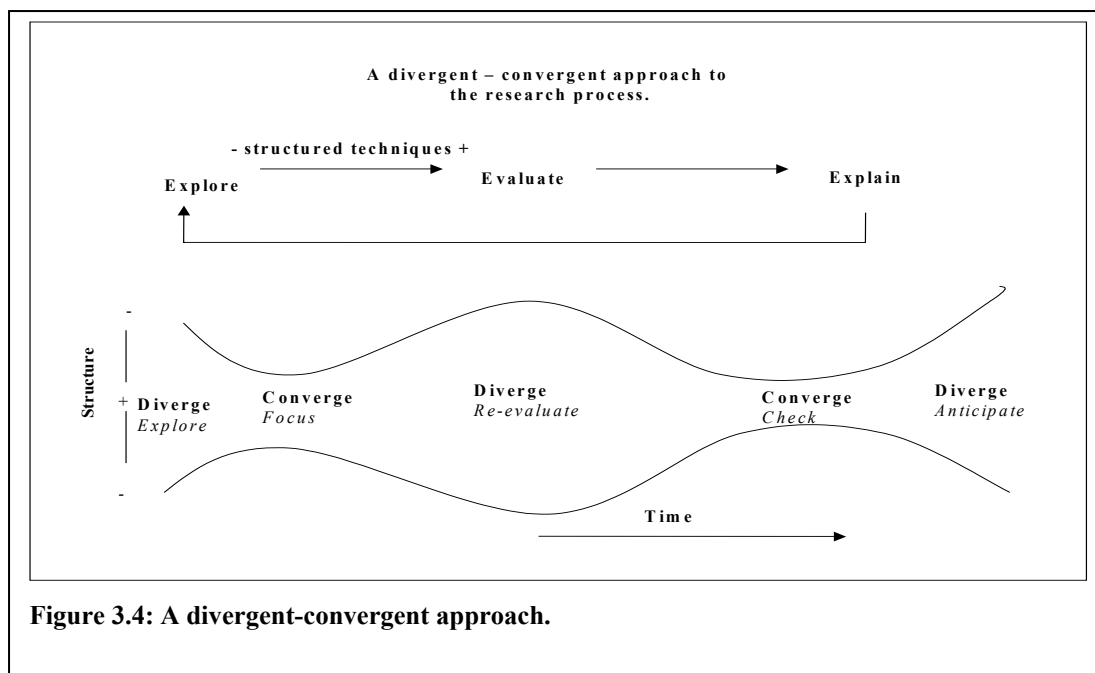
The process begins with a text, trying out coding categories on it, then moving to the identification of themes and trends, testing hunches and findings, aiming first to delineate the “deep structure” and then to integrate the data into an explanatory framework. Gherardi and Turner (1987) speak of “data transformation” as information is condensed, clustered, sorted, and linked over time. The resulting levels of abstraction are similar using the induction deduction strategies described earlier. This is shown in Figure 3.3.



### 3.5.2 The divergent-convergent approach.

The study adapts a structured and a divergent-convergent approach (see Figure 3.4). This approach becomes evident at each stage of research. In the Exploratory Phase of the study initial meetings with the sponsors explored the broad issues of interest and concerns to the organisation (diverge). This led to the identification of the aims, objectives and research method for the study (converge). Also identified were the various domains of research within BT that would form the focus of this study. Next, in Phase One of the study data collected through semi-structured interviews provided an understanding of the research context and led to the identification of the

six elements affecting innovation capability. These findings were then presented to an interactive workshop for validation and discussion (converge).



Phase Two involved document analysis. A collection of company reports, and the company Intranet were examined (diverge). These were synthesised with the seven elements which led to the identification of six cultural dimensions (converge) and the development of an initial conceptual model of organisational culture. This phase ended with the presentation of the amended model to interactive workshops (converge). The semi-structured interviews undertaken in Phase Three (diverge) provided the data for the further development of four cultural archetypes and their respective knowledge dynamics (converge).

### 3.6 Conclusions to the chapter.

This chapter described the research design that will be used to address the specific aim and objectives of this study. The objectives of the fieldwork were presented and the multi-method approach described. A number of research techniques were discussed, which included the choice of semi-structured interviews, content analysis and the use of interactive workshops. Finally the research strategy was discussed with reference to the inductive-deductive and convergent-divergent approaches. An appraisal of the choice of the research method is done in Chapter Ten.

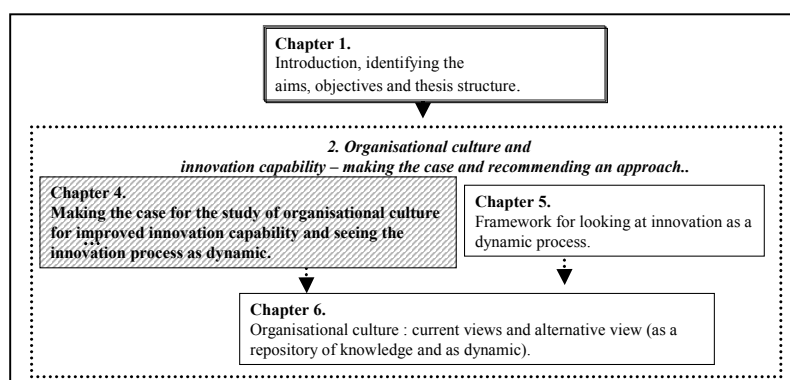
The next chapter introduces Section Two of the thesis and looks at a number of literatures on innovation and R&D. It makes the case for looking at the innovation

process as dynamic and organisational culture as an important determinant of innovation capability.

## Chapter 4: Making the case for organisational culture.

### 4.1 General introduction and purpose of chapter.

This chapter is the first of three chapters that forms Section Two of the thesis and describes a number of literatures that makes the case for considering innovation as a dynamic process. To respond to this organisational culture is considered as an important determinant of innovation capability.



To date there has been little effort to synthesize the dimensions of organisational culture that have been studied or, more importantly, to identify which of these are most related to improved innovative capability. A dearth of research has to be addressed, and systematic empirical research carried out, so that the interest in organisational culture as a determinant of innovation capability is kept alive. This thesis focuses particularly on this and provides an understanding of its relationship with innovation capability.

### 4.2 Innovation - a definition.

The most significant departure of innovation research from that of R&D is in the definition of innovation. The provision of a clear definition of innovation is an intractable task since the notion embraces both technological and commercial success. The very meaning of the term has been contentious and problematical. It is often used loosely and interchangeably with such terms as *creativity*, *invention* and *change*. This is in fact the first problem because the concept is deployed with such imprecision and variation that it can be seen to mean almost anything. However some commentators have wanted to distinguish between “invention” and “innovation”. The Department of Trade and Industry (DTI) for instance has defined innovation as “the successful exploitation of new ideas”. In a similar vein, some have sought to restrict its meaning to instances where firms have



been first to commercialise a new product or processes in the market (Teece, 1987). Researchers have also argued that qualitative factors, such as perceived value or customer satisfaction, should be taken into account (Baker *et al.* 1993; Pinto and Mantel, 1990). The Oslo Manual, which sets out to standardize the collection process of innovation data (OECD, 1997), has defined technological innovations as significant improvements in business performance. They are attributed to the introduction of new technological processes. More specifically:

1. Product innovation. A new product whose performance differs significantly from that of previous products (major innovation) or an existing product whose performance has been enhanced substantially (incremental innovation).
2. Process innovation. A new or improved production method, either hardware or software, that significantly increases production efficiency, reduces production cost or upgrades the composition of production factors.
3. Innovative firm. A firm that achieves either product innovation or process innovation (or both) during the reference period.

Schumpeter (1934) defines innovation as the implementation of new combinations, which include product and process innovations as well as organisational innovations and the new access to markets or consumers. Innovations have been frequently regarded as the outcome of a distinct linear process, which begins with the generation of an invention, i.e. the identification of an idea within the sector of business research. The invention is then used in the development of a product that is marketed (Werker, 2001). The last stage of this process is the diffusion of the marketed product (Steinmueller, 1994), which is often called innovation. Whatever relative degree of novelty is involved, such an activity requires a whole series of management processes ranging from environmental scanning, an understanding of the threats and opportunities, an assessment of internal capabilities, the acquisition and mobilization of resources and capabilities and the deployment and management of these resources and capabilities in pursuit of the chosen end. In other words there is a strong link between innovation and strategy and there is literature that recognises innovation as closely intertwined with business strategy (Ettlie, 1984; Markides, 1997; Quinn, 1979; Saren, 1987; Starkey and Mckinlay, 1988).

#### **4.2.1 The definition of innovation in this thesis.**

Innovation in this thesis is described as the conscious ‘creation’ of something new or the conscious reformulation and use of something that is already in situ. The process – an important term – encapsulates invention (e.g. new technologies) and adaptation (e.g. of those technologies or organisational structures and procedures). We can:

1. Develop new technology, structures or procedures in response to a new problem.
2. Develop new technology, structures or procedures in response to an existing problem.
3. Adapt current technology, structures or procedures in response to a new problem.
4. Adapt current technology, structures or procedures to an existing problem.

These areas of innovation are not mutually exclusive. For example the development of a new technology might draw upon high levels of technical creativity whereas the ‘drive to market’, and the innovative strategies associated with that, might place considerable and potentially unwelcome restrictions upon that creativity. The conflicts inherent in ‘downstreaming’ and the routes identified for this process identifies different forms of innovation and highlights the need for a strategic overview to link them.

#### **4.2.2 Types of innovation.**

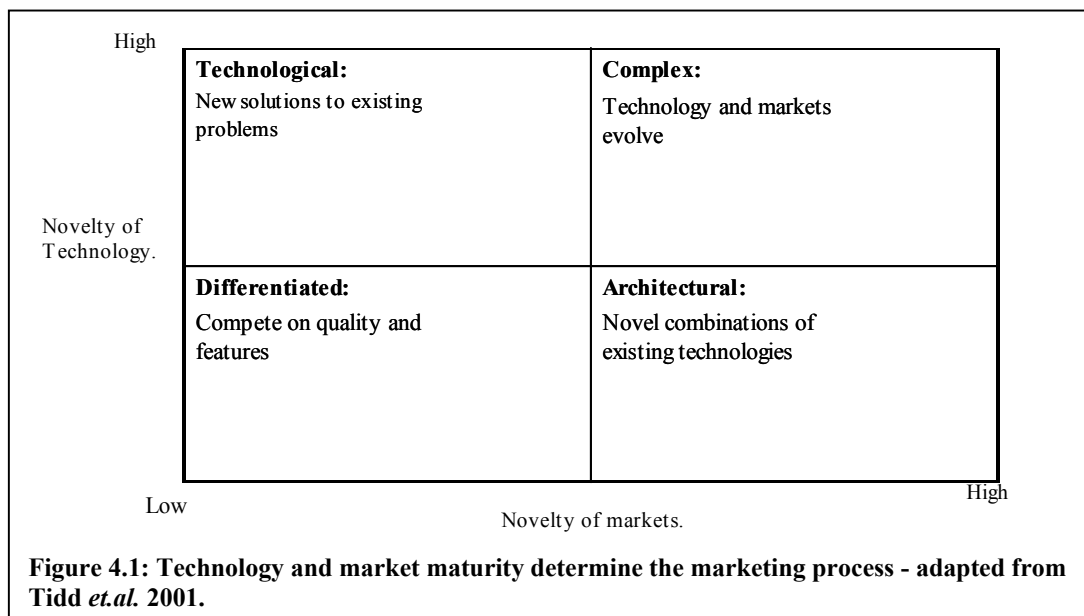
The level of innovation ranges over a wide spectrum and the level of “newness” in a product innovation can vary considerably. Wheelwright and Clarke (1992) describe three classes of innovation in new products – incremental, new generation, and radically new. An incremental innovation is one where the basic technology and product configuration remains essentially the same and only minor modifications are made to the performance, flexibility, appearance and other characteristics. The incremental innovation is usually attempted in a well-established market, (Ali, 1994). Sony for example came out with a number of incremental innovations for their Walkman product in the 1980’s, but the market was established and the customer well identified.

A radical innovation is one where the technology is considerably different from the earlier product and the market may not exist at all. The product design in such cases may be based solely on the creative instincts of the designer by understanding the user needs through empathy with the user world, what Leonard-Barton (1994), calls empathic design. Where the market uncertainty is very high, performing a detailed market analysis may be impossible and fruitless. The nature of the innovation has different effects on

markets and organisational factors affecting the success of the new product or R&D project.

In the case of a radical innovation it is much harder, if not impossible to forecast and perform early analysis on customer needs, market size, market growth and competition. Consequently using formal market analysis is relatively less important. The organisation of radical innovation has been shown to differ from that of incremental innovation (Johne and Snelson, 1988). Incremental innovation requires an extensive market analysis.

**4.2.3 Market types that affect innovation.** The nature of the market can be categorized into two types - existing and new. In the former case, the new product meets an existing need but with some improvements and therefore market uncertainty is relatively low. In the latter case, it meets a latent need and the uncertainty of the market can be therefore very high. The market analysis for the two is completely different (Shanklin and Ryans, 1987) because the quality of the information about the market and customers will differ, as will the factors influencing innovation. Entry timing, positioning and scale of entry are three factors that can make a substantial difference to the prospect of new products (Trott, 1998).



Green *et al.* (1995) caution that simple nostrums, such as early entry is best, can be dangerous oversimplifications although there is evidence that pioneers accrue “first mover advantages”.

Buzzel and Gale (1987) have shown that pioneers can set standards, establish a distinctive quality position, take the lead in the continuing evolution of the technology and gain valuable experience. Positioning decisions can be influential and the scale of entry affects how products perform and how the market evolves. Technological and market maturity also determine the marketing process (Tidd *et al*, 2001), see figure 4.1.

Briefly, in the differentiated quadrant, both the technologies and markets are mature and most innovations consist of the improved use of existing technologies to meet a known customer need. Products and services are differentiated on the basis of packaging, pricing and support. In the architectural quadrant, existing technologies are applied or combined to create novel products or services or new applications. Competition is based on serving specific market niches and on close relations with customers. Innovation typically originates or is in collaboration with potential users. In the technological quadrant, novel technologies are developed which satisfy known customer needs. Such products and services compete on the basis of performance, rather than price or quality. Developers mainly drive innovation. Both technologies and markets are novel in the complex quadrant. There is no clear defined use for the new technology, but over time developers work with lead users to create new applications.

#### **4.2.4 Classifying technology.**

One useful measure of classifying technology is high tech verses low tech. As has been discussed earlier, the uncertainties in market and technology are different for the two groups. Link (1987) observed that in the high tech field, the technology was developing very rapidly, resulting in quicker new product introductions although the applications and customers may not be determined if the technologies were still emerging. This had an impact on the marketing and technology factors. Because the standards for the products and their performance are not yet seen, early market entrants can be hurt by later developments. In low technological innovations, the areas are well defined, and the new products have to conform to many of the well-established standards and practices and so have to provide an advantage within this structure. One of the axioms of technology is that what is high tech today will be low tech tomorrow.

#### **4.2.5 Some concerns in the study of innovation.**

Few issues have been characterized by as much agreement among organisational researchers as the importance of innovation to organisational competitiveness and

effectiveness. There is no executive task more vital and demanding than the sustained management of innovation and change and to compete in the new environment, companies must create new products, services and processes and adopt innovation as a way of corporate life (Tushman and Nadler, 1986).

Consequently, predominantly normative theories have been advanced offering prescriptions for improving the innovation capabilities of firms. However, despite an extensive literature and the depth and extent of empirical research, a dominant theory, or in fact, a consistent body of theory remains elusive (Fiol, 1996; Wolfe, 1994). Wolfe (1994) argues that

*“the most consistent theme found in the organisational innovation literature is that its research results have been inconsistent” (pp 405).*

The failure to clearly specify the nature of focal innovations and organisational context has prevented generalizations from such studies (Wolfe, 1994). Of the circumscribed theories of innovation that do exist, each applies under differing conditions. Some researchers also suggest that there is a problem with the overall body of research on innovation management. Tidd (1997) notes that it is

*“highly fragmented...much of the research has been conducted within three separate disciplines with relatively little overlap and interaction” (pp.1).*

These disciplines are: the management of research and development of technology; new product development and marketing; and organisational development and change. Tidd (1997) suggests that

*“there is a clear need to develop a conceptual and analytical framework which encourages a more integrated approach to the study of innovation” (pp.2).*

Other reviews of the literature have come to a similar conclusion (Dougherty, 1996; Wolfe, 1994). Wolf (1994) for example observes that

*“our understanding of innovative behaviour in organisations remains relatively underdeveloped” and the results of the organisational research have been “characterized by a low level of explanation” (pp 405).*

Two responses to this state of affairs have occurred: the first is to seek an integrative framework and the second is to intensify the search for the critical variable or combination of variables which might better explain how innovation can be managed to the best effect (Storey, 2000).

Van de Ven *et al.* (1989) suggest that the underlying structure of innovation can be represented by the metaphor of an innovation journey, which has the key phases of

initiation, development, and implementation/termination. But the progress of any particular innovation along this route will depend on a variety of contingent circumstances.

#### **4.2.6 Contingencies affecting innovation.**

Damanpour's (1991) review of 23 studies of organisational innovation identified four contingencies that might affect the management of innovation: type of innovation, stage of innovation, scope of innovation, and type of organisation. The review concludes that the scope of an innovation and the type of organisation have a more moderating effect than the type or stage of innovation. However, the typology of innovations used by this review was too crude to identify the potential effect of the innovation type. Innovations were classified simply as being technical or administrative, product or process, and radical or incremental. A finer categorization needs to be used to capture the degree of complexity of an innovation (Tidd, 1997).

It is imperative therefore, that effort should be directed at determining the contingencies that govern when various innovation theories apply. Furthermore, systematic and meaningful comparison to other innovations is rendered impossible without knowledge of an innovation's attributes.

#### **4.2.7 Theories of innovation.**

While many models of innovation at the firm level have attempted to improve research consistency, they have occupied a variety of theoretical positions including institutional theory, cognitive theories, transaction cost economics, socio-technical approaches, market orientation (MO) and the resource-based view. Each theory contributes a piece of the innovation puzzle (Lawson and Samson, 2001). Many firms and academics have suggested that innovation management may be sector or industry specific, if not firm specific. Evidence however suggests that a number of core elements and processes exist which aid effective innovation capabilities (Tidd *et.al.* 1997). Firm level differences, such as competitive environment, strategy, task complexity and management style means that the importance of each innovation process may vary across firms.

#### **4.2.8 Barriers to innovation.**

The problem of innovation is long standing and the sources of the problem have been investigated at many levels and from diverse perspectives. There is a large literature exploring the barriers to innovation (e.g. Storey, 2000) that has identified a whole array

of factors from the macro to the micro level. At the macro level, issues of financing and short-termism have been highlighted. Some have focused on organisational structures and cultures while others have addressed issues of team dynamics and individual personality traits. Prescriptions exist for enhancing individual creativity (Frarr, 1990), forming innovative groups and teams (Anderson *et al.* 1992; Kantz, 1994), promoting organisational innovation (Rosenfeld and Servo, 1990) and using inter-firm partnerships, alliances and networks for innovation (Hargon and Sutton, 1997; Quinn, 1992). Despite this degree of attention, organisations continue to have problems innovating effectively (Dougerty 1996). Cooper and Kleinschmidt (1986), have observed that

*“what literature prescribes and what most firms do are miles apart” (pp73).*

#### **4.2.9 Streams in the organisational literature on the study of innovation.**

The nature of technological innovation varies from industry to industry although some common traits exist (Pavitt, 1990, 1991; Kodama, 1995). The organisational literature on innovation indicates that it is composed of three discernible streams: diffusion, innovativeness and the process based view that developed somewhat sequentially (Wolfe, 1994). While the three streams are concerned with the general phenomenon of organisational innovation, they have different foci as each addresses a different question, has a different unit of analysis and a different dependent variable. These three research approaches and their corresponding questions and foci are as follows:

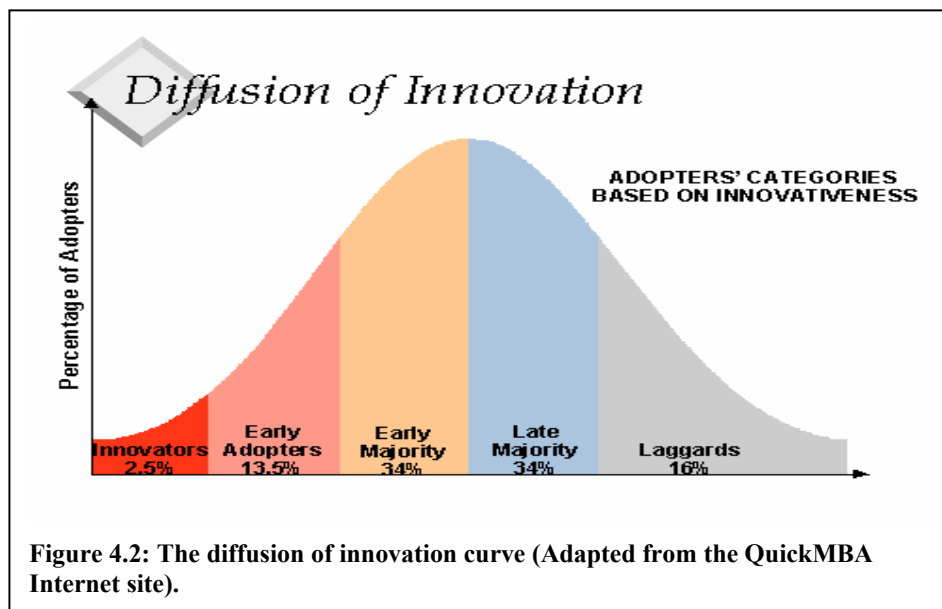
*Diffusion of Innovation.* This refers to its (innovation) spread through a population of potential adapters. A great deal of research has been conducted to try and identify what factors affect the rate and extent of adoption for an innovation. The unit of analysis is therefore the innovation. The objective is to explain or predict rates and patterns of innovation adoption over time and/or space. Factors that have been found to influence diffusion include; adapter characteristics, the social network to which the adapters belong, innovation attributes, environmental characteristics, the process by which innovation is communicated and the characteristics of those who are promoting an innovation (Rogers, 1983). A number of innovation characteristics have also been found to affect diffusion (Tidd *et al.* 2001). These are:

1. *Relative advantage*, which is the degree to which an innovation is perceived as better than either the product it supersedes or competing products. Primary attributes, such as size and cost that are invariant and inherent to a specific

innovation, irrespective of the adopter, are distinguished from secondary attributes such as relative advantage and compatibility, which may vary from adopter to adopter.

2. *Compatibility*, which is the degree to which an innovation is perceived to be consistent with the existing values, experience and potential needs of the adopters. There are two distinct aspects of compatibility – existing skills and practices and values and norms.
3. *Complexity*, which is the degree to which an innovation is perceived as being difficult to understand and use. In general innovations that are simpler for potential users to understand will be adopted more rapidly than those that require the development of new skills and knowledge.
4. *Trialability* is the degree to which an innovation can be experimented with on a limited basis. An innovation that is trialable represents less uncertainty to potential adopters, and allows learning by doing.
5. *Observability* is the degree to which the results of an innovation are visible to others. The easier it is for others to see the more likely it will be adopted.

The diffusion of an innovation is typically described by an S-shaped (logistic) curve (Fischer and Carrol, 1986) – see Figure 4.2.





Initially, the rate of adoption is low, and adoption is confined to the so-called “innovators”. Next to adopt are the “early adopters”, then the “late majority” and finally the curve trails off as only the “laggards” remain. Tornantsky and Fleischer (1990) classify adopters as innovators, early adopters, early majority, late majority, and laggards. There are many exceptions to the S-shaped curve and it is not known when and why the curve applies. Mohr (1987) concludes that diffusion curve research has made limited contributions to our understanding of the diffusion of innovations. Simplistic and inappropriate “anthropomorphising” of organisational characteristics (Yin, 1978) have contributed to a disappointing diffusion of innovation results (Rogers, 1978).

*Organisational Innovativeness.* The objective of this research is to discover the determinants of an organisation’s inclination to innovate. The unit of analysis is thus the organisation. While researchers have investigated the influence of individual, organisational and environmental variables in organisational innovativeness studies, this stream has focused on the influence of organisational structure, perhaps because it has been argued that structural variables are the primary determinants of organisational innovation (Damanpour, 1988, 1991; Kim, 1980; Kimberly and Evanisko, 1981). However, no set of characteristics that differentiates more from less innovative organisations has emerged (Rogers, 1983; Tornatzky *et al.* 1983). Downs and Mohr (1976) suggest switching the unit of analysis from the organisation to the “innovation-in-an-organisation”. Elsewhere Van de Ven *et al.* (1989), Mohr (1987) and others have suggested moving away from a static, over determined, perspective towards investigations of the factors that influence the innovation process.

*Process Based View.* This research into organisational innovation investigates the nature of the innovation process. Explanations about how and why innovations emerge, develop, grow and terminate are sought and the unit of analysis is the innovation process itself. Organisational innovation is decomposed to its component phases and the investigation focuses on the sequential nature of precursor events and on their determinants. There are two generations of process-based view of research. Earlier work called *stage model research* conceptualizes innovation as a series of stages that unfold over time. The purpose of this research is to determine whether the innovation process involves identifiable stages and if so, what they are, and what their order is. Stage models tend to fall into two types, the creative problem solving and the new-product development

models. Typical of the creative-problem solving type is the Osborne-Parnes model and its variants (Isaksen and Treffinger, 1985). The process is initiated by sensitivity to a problem and defining an objective for solving it. There are five stages in the model. These are fact-finding, problem finding, idea finding, solution finding and acceptance finding. The process concludes with action and continues on to new challenges.

Typical of the new-product development type of stage models are the development funnel (Wheelwright and Clark, 1985), product innovation process (Crawford, 1994), stage-gate process (Cooper, 1993), and invention-exploitation (Roberts, 1988). They are characterised by sequential stages that are separated by screens or milestones. The stages in the development funnel are idea generation, project definition, concept development, detailed development, and market launch. In the stage-gate process the stages are ideation, preliminary investigation, detailed investigation, development, testing and validation, full production and market launch. The stages in the product innovation process are strategic planning, concept generation, pre-technical evaluation, technical development, and commercialisation. The screens in the new product development models highlight the elimination or consolidation of competing ideas in the process. When a simple innovation is borrowed or adapted from an external source, stages tend to occur in the expected order, however, when innovations are complex and / or originate within an organisation, stages tend to be muddled up and overlapping (Pelz, 1983, 1985). Stage model research, that of providing an organizing framework, can be deceiving as innovation is often not simple or linear, but is rather a complex interactive process having many feedback and feed forward cycles (Schroder *et al.* 1989). This research is limited because many interesting and important innovations are complex and/or originate within the adopting organisation. The processes involved in their implementation, therefore are not accurately represented by simple, sequential stage models.

Another stream of research within the *process based view* involves an in-depth longitudinal research conducted to fully describe the sequences and conditions that determine the innovation processes. This research often involves theory building and qualitative data collection. Various stage models have been proposed as a result. Each tends to be a variant on the following general pattern. A decision-making unit becomes aware of an innovation's existence, a problem or opportunity is matched to the innovation, and the innovation's costs and benefits are appraised. Next the sources of

support and/or opposition attempt to influence the process, and a decision made to adopt (reject) the innovation. Once the innovation is implemented the innovation decision is reviewed and confirmed (reversed), the innovation gets accepted as routine and infused, i.e. is applied to its fullest potential (Wolfe, 1994).

### 4.3 Research and development (R&D).

This section examines the literature on research and development. It starts with defining R&D, followed by the stages of R&D activity. Factors determining the success or failure of R&D and new product development are described next. The section concludes with a short discussion on the strategic management of technology.

#### 4.3.1 R&D definitions.

Twiss (1992) defines R&D (research and development) as the

*“purposeful and systematic use of scientific knowledge to improve man’s lot even though some of its manifestations do not meet with universal approval” (pp. xvii).*

This implies that R&D outcomes can deliver controversial outcomes. Roussel *et al.* (1991), define R&D as the ability of organisations to develop new knowledge, apply scientific or engineering knowledge, and to make connections between the different nodes of organisational knowledge.

#### 4.3.2 Stages of R&D activity.

R&D should be viewed as a continuum with scientific knowledge and concepts at one end and physical products at the other.

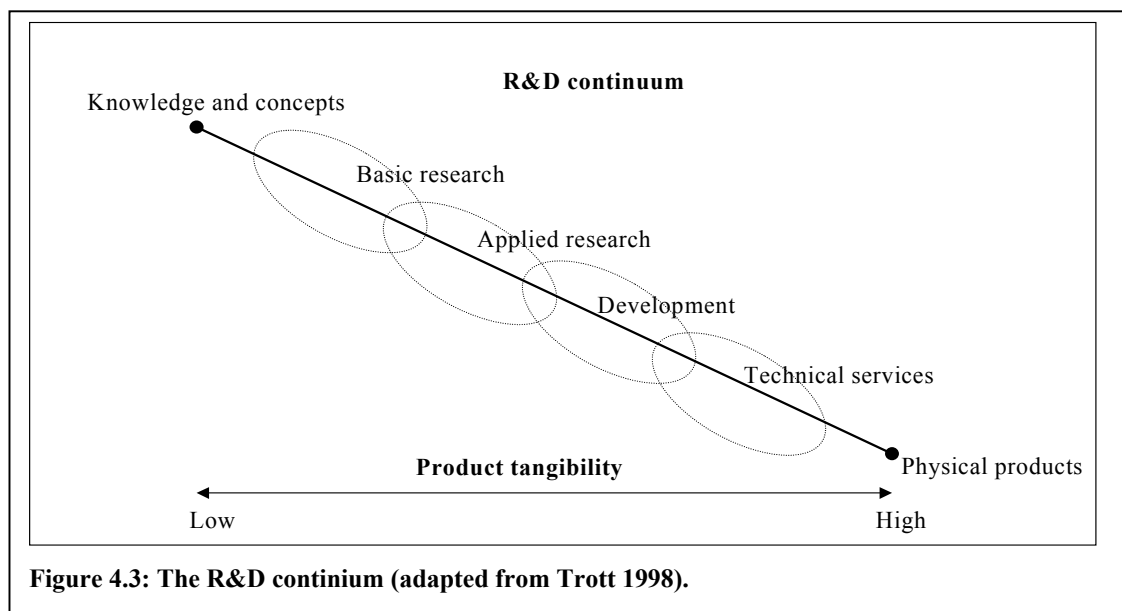


Figure 4.3: The R&D continuum (adapted from Trott 1998).

It is possible to place the various R&D activities along this continuum (Trott, 1998). See figure 4.3. *Basic research* is also referred to as fundamental science and is usually conducted in the laboratories of universities and large organisations. It involves work of a general nature and is intended to be applied to a broad range of uses or to provide and support new knowledge about an area. *Applied research* is also referred to as the application of science. The activity involves the use of existing scientific principles for the solution of a particular problem and may lead to new technologies and include the development of patents. *Development activity* involves overcoming a technical problem associated with a new product. The activity is similar to applied research in that it involves the use of known scientific principles, but differs in that the activities centre on products. *Technical service* then focuses on providing support to existing products and processes.

R&D activities tend to be carried out in different units and at different levels of the same organisation, for example corporate and business units (Kay, 1988; Lewis and Linden, 1990; Eto, 1991), or in different locations e.g. home country and subsidiaries (Howells, 1990; Hakanson, 1992; Casson, 1991). This implies that the R&D carried out within a firm includes activities of a different nature to that on innovation.

Traditionally R&D has been seen as a series of stages mirroring the progress of a certain technological program (research, development, engineering). Hedlund (1986) states that R&D strategy can be seen as action patterns over time, of which there are two related aspects. These are programmes of (i) experimentation, the primary aim of which is to seek opportunities, and (ii) programmes of exploitation seeking the effective use of given resources. The characteristics of the experimentation phase are the continuous search for new techno-organisational solutions, and a learning process aimed at enhancing the firm's knowledge base. Exploitation programmes create value through current activities, and innovate by exploiting the skills embedded in a firm's human resources and technical systems. This in effect means that experimentation programmes define future approaches while the exploitation programme seeks to identify and use the potential of the current paradigm.

Coombs (1996) has stated that R&D has two major articulations: the investment mode, in which activities are concerned with the development of the firm's technological capabilities, and the harvesting mode in which the R&D function participates with other

functions to the market-driven exploitation of specific artefacts and services for customers. He also underlines the changes in the characteristics of technology associated with the two ways of employing R&D activities. Whereas in the investment mode, the product of the R&D activity is technology seen as knowledge and skills (formal abstract representation of technology in codified form, the capabilities to employ it, the related tacit knowledge), the output of R&D activity in the harvesting mode is a functionality profile and a technological recipe (the choice of the particular combination of technologies, design practices, configurations of sub systems able to provide a certain range of service and performance).

Kodama (1995) also identifies two major stages in the R&D programme, the exploratory stage and the development stage. The first includes fundamental research and exploratory development; the second includes advance development, engineering development and operational systems development. The transition from the exploratory to the development state is given by the sharp growth in the expenditure for an R&D program, and in certain R&D processes, by a variation in perceived risk.

Pavitt (1984, 1990, 1991) identifies different patterns of technological change and sources of innovation. His taxonomy of the types of R&D process highlights the internal R&D activities that play a different role in different industries, and in certain industries are not major sources of innovation. Dominant design, science based, and high tech are three types of R&D process identified by Kodama (1995). The three patterns are characterised by a different degree of risk of failure along the programme. The dominant design patterns have the characteristic that the probability of cancelling a programme in the development phase is zero. High tech processes show a decreasing probability to cancel a programme in the development stage with respect to the research phase, but is greater than zero. In science-based processes there is an equal probability of cancelling the programme before and after it has entered the development phase.

#### **4.3.3 Factors determining the success or failure of R&D.**

Many research studies have attempted to discover the critical factors that can indicate the success or failure of R&D projects and new product introductions. These show that there are a large number of factors influencing the success of a new product or an R&D project aimed at developing a new product. Some of them are controllable from within the organisation but others are external and uncontrollable.

Balchandra and Friar (1997) suggest three major groups of contextual variables for successful new product innovation and R&D projects: the nature of the innovation, the nature of the market and the nature of the technology. They mention a possible fourth group – the nature of industry although there is not enough evidence in the literature to develop any hypothesis for this group. One could argue that in different industries what really affects the outcome of an R&D project or new product development is dictated by the above three contextual groups.

There is also a growing interest in the role of political processes within organisations in the creation of new products. These approaches are emerging in opposition to a dominant “rationalistic” perspective based on the assumption that

*“a product that is well-planned, implemented and appropriately supported will be a success” (Brown and Eisenhardt, 1995, pp 334).*

Research that has focused on the decision making process involved in new product development has drawn attention to the role of what has been termed as “disciplined problem solving” (Imai *et al.* 1985; Clark and Fujimoto, 1991). The suggestion is that effective new product development requires the exercise of “subtle control” by senior management, who must create a strong vision for a new product, to ensure outcomes fit with corporate objectives, but at the same time leave sufficient ambiguity for “experiential improvisation” within the development team. Brown and Eisenhardt (1995:351) ascribed this balancing to “heavyweight” team leaders. A more sophisticated understanding of the role of political process is found in studies that focus on the significance of information flows and communication to successful product development (Allen, 1997). Frost and Egri (1991) draw attention to the means by which the resources required for successful product development are secured by project teams. The political processes involved in learning and trust building in the context of developing new products and general collaboration within and between firms has also been highlighted (Cohen *et al.* 1998; Dickson, 1996).

#### **4.3.4 Strategic management of technology.**

The field of technology management has evolved from earlier work on technological change and science policy but with greater emphasis on the firm (Tidd, 1997). Drejer (1996) identifies four schools of research, ranging from the early work on R&D management through to the more recent emphasis on the strategic management of

technology. The different schools of management can be differentiated in terms of the assumptions made concerning the task and process of technology management. The task defines the relevant issues and variables considered, and the process determines how these are best managed and deployed. In the case of R&D management, the primary task is to allocate R&D funds and the process includes budgeting, assessment and selection (for examples see Foster, 1986; Twiss 1992). The primary task of the school of strategic management of technology is to integrate technology management with business needs and includes designing organisational structures and processes that help integrate different divisions and functional groups (examples of such work include Roussel *et al.* 1991; Lawless, 1994).

#### **4.4 Limitations to the study of innovation and R&D.**

The main limitation of the research discussed in the preceding sections is the primacy given to technological innovation whereby the market and organisational change are assumed to flow from technological innovations (Tidd, 1997). Research on the management of new product development and marketing has taken the broader perspective, and examined the technological, organisational and market forces that affect the success of specific products. Relationship marketing is the current fashion in marketing literature and practice and in essence is the concept of working closer with customers in order to satisfy their requirements.

Von Hippel's (1998) work has encouraged firms to identify and form relationships with "lead" users, and Nishiguchi's (1994) perceptions of Japanese manufacturers have led many firms to form closer relationships with customers in order to identify their requirements. Such prescriptions, however give minimal attention to the characteristics and types of innovation. The problem of not specifying innovation attributes remains a substantial obstacle to the generalisability of innovation research (Wolfe, 1994). Cooper and Klienschmidt (1993) have for instance emphasised the importance of "understanding user needs" when developing new products. However in the case of radical new products and services potential users may not be aware or able to articulate their needs. Further factors such as the selection of suppliers and users, the timing and mode of their involvement, and the novelty and complexity of the system being developed may reduce or negate the benefit of supplier-user links (Leonard-Barton, 1995). Future research on

product development needs to take into account the complexity of technologies and novelty of applications when specifying organisational linkages (Tidd, 1997).

Studies of organisational innovation, which are located in the fields of organisational development and change, have been characterised by pragmatism (Tidd, 1977). Despite numerous case studies of specific change programmes there have been relatively few theoretical developments to guide research or conceptual frameworks to guide practice (Hendry, 1996).

The current state of the literature offers little guidance to those who want to influence organisational innovation (Myer and Goes, 1988; Van de Ven and Angle, 1989). Recently there has been a convergence among innovation scholars indicating that there can be no one theory of innovation, as the more we learn, the more we realize that the “whole” remains beyond our grasp. Several limited theories of innovation exist, but each applies under different conditions, therefore, researcher effort should be directed at determining the contingencies that govern when various innovation theories hold (Abrahamson, 1991; Eveland, 1991; Mohr, 1987).

This literature review identifies a number of different models, some focusing on the process others on the outcomes of any innovation process. Most of these are conceptual, however contextual models have started to appear for explaining different aspects of innovation. As one would suspect there may be only a few universal factors that help identify successful new products or R&D projects. Factors deemed successful for product innovation can vary not only in magnitude but also in direction, depending on the context. In organisational terms, the source of ideas and use of quantitative techniques are prime examples of factors that will vary depending on the level of innovation.

An approach to innovation management, which incorporates a synthesis of current and past approaches, contingent upon the multidisciplinary needs of a specific organisation, is a perspective, which in recent years is gathering support (Price-Waterhouse, 1996; Tidd *et al.*, 1997; Tyson 1997).

Eccles (1992), when discussing the deluge of new approaches that appear in modern literature, highlights the risk of fanatically supporting “new” approaches and as a result misunderstanding and neglecting the lessons available from past approaches. Burke (1987) emphasizes the value of the contingency based approach to organisational innovation and stresses that there is no one single, all encompassing theory and what we



have are a number of mini-theories that help us understand certain aspects of organisational behaviour. Taken together and comparatively, they become useful.

There is no one universal model encompassing the success and failure of either new products or R&D projects. In an important programme of case study based research looking at widely different innovation types, Van de Ven (1989) and colleagues explored the limitations of simple models of the process. They drew attention to the complex ways in which innovations actually evolve over time.

This review exposes many contradictions about the effects of different factors on the success of innovation, new product development and R&D projects and leads to the conclusion that there is no one universal model that adequately encompasses its success or failure. The adoption of a single perspective, whatever that might be, limits the scope of a researcher's inquiry and thus limits the extent to which the researcher can capture the innovation process, which is complex, non-linear, tumultuous and opportunistic. Researchers adopting different schools of thought tend to have narrow perspectives of issues. They also use different logics and vocabularies thus contributing to the non-cumulative nature of the literature. Even though explanatory variables recur with great consistency in innovation studies, researchers foci vary and interpretations of study results are a function of researcher perspective (Huberman, 1987). Initial conceptualizations in innovation studies were heavily rationalistic as researchers adopted orientations that were deterministic and objective.

#### **4.5 An alternative perspective.**

A multiple perspective approach to understanding innovation is recognised as necessary. Hence it is all the more important for managers to approach innovation with an awareness of the many factors, and interactions that underly the process. It would appear that a particular model may be useful in leading to success in some contexts but may lead to failure or be unimportant in a different context. Given the importance of contextual variables, frameworks or models should take into account these contingencies. A recent review of research on innovation management calls for re-examination of the relative importance of organisation context and industry dynamics on the generation and adoption of innovations (Drazin and Schoonhoven 1996) an approach subsequently adopted by Tidd *et.al.* (1997). Van de Ven and Rogers (1988) suggest that an interpretive orientation holds great promise arguing that innovation, being uncertain and intricate, can best be

understood from the point of view of the actors involved in the actual process. This thesis is built around this notion.

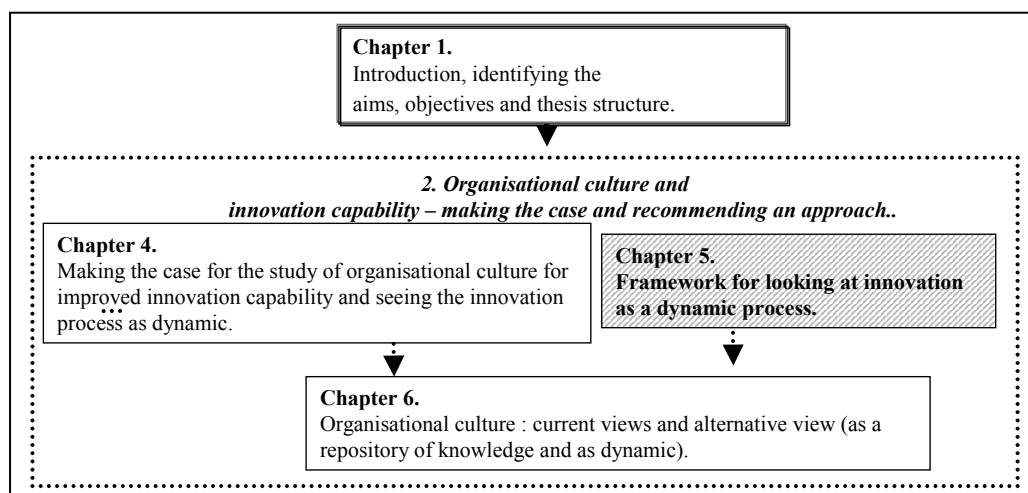
#### **4.6 Conclusions to the chapter.**

This chapter showed that research in the management of innovation was highly fragmented and non-cumulative, the innovation process non-linear and that current models incorporating simple feed back loops too imprecise to have much explanatory power or practical implications. Limitations to the current approaches were outlined and the need to develop a better characterisation of organisational contingencies that affect the opportunities for, and the constraints on, innovation capability presented. A study of organisational culture can address these limitations and provide context specific responses.

This chapter has made the case for considering the innovation process as a dynamic process and the next chapter provides a framework for doing so by using the literatures and concepts from the widely researched areas of dynamic capabilities of the firm, knowledge management, organisational learning and systems thinking.

## Chapter 5: Framework for looking at innovation in an R&D environment as a dynamic process.

### 5.1 Introduction and purpose of chapter.



The last chapter made the case for looking at organisational culture as an important factor affecting innovation capability and saw the innovation process as dynamic. The purpose of this chapter is to describe the literatures that will provide the framework for looking at innovation as a dynamic process. A combination of approaches that includes understanding a firm's dynamic capabilities, knowledge management, organisational learning, and systems thinking (systems archetypes) are presented.

### 5.2 Dynamic capabilities.

This section provides a background to the resource-based view of the firm. Within this the knowledge dynamics of organisational culture can provide an organisation with the dynamic capability to respond to changes and challenges in its environment.

#### 5.2.1 Strategy and the resource based view.

The principle developments in strategic planning during the 1980's focussed upon the link between strategy and the external environment. For example Porter's (1985) analysis of industry structure and competitive positioning and empirical studies undertaken by the PIMS - Profit Impact of Market Strategy project - a database containing experiences of over three thousand businesses. Hofer and Schendel (1978), define strategy as the match an organisation makes between its internal resources and skills and the opportunities and risks created by its external environment. Most research on the strategic implications of the firm's internal environment was concerned with issues of strategy implementation and analysis of the organisational

processes through which strategies emerge (Mintzberg, 1985; Pettigrew, 1977; Quinn, 1980). Renewed interest in older theories of profit and competition (Ricardo, 1981; Schumpeter, 1934; Penrose, 1959) has dominated current thinking on business strategy. Recently there has been a resurgence of interest in the role of the firm's resources as the foundation for firm strategy (Grant, 1991). At the corporate level, theoretical interest in the economics of scope and transaction costs have focused attention on the role of corporate resources in determining the industrial and geographical boundaries of the firm's activities (Teece, 1980; Chatterjee and Wernerfelt, 1991). Explorations of the relationship between resources, competition, and profitability at the business strategy level included analysis of competitive imitation (Remelt, 1984), the appropriability of returns to innovations (Teece, 1988), the role of imperfect information in creating profitability differences between competing firms (Barney, 1986) and the means by which the process of resource accumulation can sustain competitive advantage (Dierickx and Cool, 1989). Together, these contributions amount to the resource-based view of the firm (Grant, 1991). This strand of literature is often referred to as the "resource based perspective" and emphasises firm-specific capabilities and assets and the existence of isolating mechanisms as the fundamental determinants of firm performance.

### **5.2.2 Resource based theory.**

The resource-based view of the firm is one of the most promising theories to evolve in the strategic management field over recent years. It brings a more systematic approach to firm level analysis by characterising the firm as a collection of resources and capabilities, rather than a set of product market positions (Wernerfelt, 1984). The theory assumes that performance differences across firms arising from valuable, rent generating, firm specific resources and capabilities cannot easily be imitated or substituted (Amit and Schoemaker, 1993; Barney, 1986, 1991; Dierickx and Cool, 1989; Hamel and Prahalad, 1994). Firms therefore compete on the *capacity* to develop new products and not on new products themselves (Prahalad and Hamel, 1990).

### **5.2.3 Dynamic capabilities approach.**

Drawing from evolutionary theories of the firm, the *dynamic capabilities* approach focuses on the relative ease or difficulty with which, and the ways in which, firms adapt in response to changes in their competitive environment. Recognition of the dynamic nature of interaction, and the fact that different levels of ability in firms to build and continuously renew essential competencies are linked to different levels of

performance, and can be traced back to Penrose (1959). Teece and Pisano (1994) further developed the area proposing dynamic capabilities theory as the subset of the competencies/capabilities which allow a firm to create new products and processes in response to changing market circumstances. Competitive advantage, therefore, rests on distinctive processes shaped by the firm's asset positions and the evolutionary paths followed. Dynamic capabilities emphasise management capabilities and inimitable combinations of resources that cut across all functions, including R&D, product and process development, manufacturing, human resources and organisational learning.

Teece *et al.* (1997) identify the dimensions of firm specific capabilities that can be a source of advantage, and explain how combinations of competencies and resources can be developed, deployed and protected. This is referred to as the "dynamic capabilities" approach in order to stress the exploitation of existing internal and external firm specific competencies in addressing changing environments.

Schumpeter (1942), Penrose (1959), Nelson and Winter (1942), Prahalad and Hamel (1990), Teece, (1976, 1988), Heyes *et al.* (1988) have all provided elements of this approach. They emphasise the development of management capabilities, and difficult to imitate combinations of organisational, functional and technological skills, and integrate and draw upon research from areas such as the management of R&D, product and process development, technology transfer, intellectual property, manufacturing, human resources, and organisational learning (Teece, *et al.* 1997). From pioneering efforts, such as Selznick's (1957) "distinctive competence", to the more recent and refined notions of organisational routines (Nelson and Winter, 1982), core competencies (Hamel and Prahalad, 1990), absorptive capacity (Cohen and Levinthal, 1990), architectural knowledge (Henderson and Clark, 1990), combinative capabilities (Kogut and Zander, 1992) and, finally, dynamic capabilities (Teece, *et al.* 1997) there are decades of investment in sorting out the traits and the boundaries of the phenomena of competitive advantage. Recent contributions (Teece, *et al.* 1997; Dosi, *et al.* 1999) aimed at providing definitions for, and distinctions between the various constructs, offer some hope that the problem of proliferating and overlapping terminologies is being alleviated and real progress is being made. The dynamic capabilities approach is promising both in terms of future research potential and as an aid to management as it endeavours to gain competitive advantage in increasingly

demanding environments (Teece, *et al.* 1997). This requires dynamic capabilities, a notion that is explored in the next section.

### **5.2.3.1 Exploring the notion of “dynamic capabilities”.**

The term “dynamic” refers to the capacity to renew competencies so as to achieve congruence with the changing business environment. Certain innovative responses are required when time-to-market and timing are critical, the rate of technological change is rapid, and the nature of future competition and markets difficult to determine. The term “capabilities” emphasises the key role of strategic management in appropriately adapting, integrating, and reconfiguring internal and external organisational skills, resources, and functional competences to match the requirements of a changing environment. Dynamic capabilities reflect an organisation’s ability to achieve new and innovative forms of competitive advantage given path dependencies and market positions (Leonard-Barton, 1992; Teece *et al.* 1997). They advance the argument that the competitive advantage of firms lies with its managerial and organisational processes, shaped by its (specific) asset position, and the paths available to it.

By managerial and organisational processes, Teece *et al.* (1997) refer to the way things are done in the firm, what might be referred to as its routines, or patterns of current practice and learning. By position they refer to the specific endowments of technology, intellectual property, complementary assets, customer base, and the external relations with suppliers and complementors. Paths refer to the strategic alternatives available to the firm, and the presence or absence of increasing returns and attendant path dependencies. Organisational processes have three roles: coordination/integration (a strategic concept); learning (a dynamic concept); and reconfiguration (a transformational concept). In rapidly changing environments there is value in the ability to sense the need to reconfigure the firm’s asset structure, and to accomplish the necessary internal and external transformations (Amit and Schoemaker, 1993; Langlois, 1994). In such environments, narcissistic organisations are likely to be impaired because the capacity to reconfigure and transform is itself a learned organisational skill (Teece *et al.* 1997).

### **5.2.3.2 Dynamic capabilities and innovation.**

An explicit examination of innovation is usually omitted in the discussion of dynamic capabilities (Lawson and Samson, 2001). Innovation is a key mechanism for organisational growth and should be considered implicit to Dynamic Capabilities Theory for a number of reasons (Lawson and Samson, 2001). First, there is no special

focus on technology. R&D for instance is but one resource among many available to the firm. This facilitates the development of a holistic model of organisational innovation. Second, the innovation process may just as easily relate to the development of new products as it can to new processes, systems or even business models. Moreover the requirement of asset heterogeneity reflects the observation that there is no one generic formula of innovation capability. Tidd *et al.* (1997), however have shown common themes in highly and lowly innovative firms varying only in degrees of importance.

Almost by definition, most technological and market competencies are firm specific, based on experience and accumulated over time (Tidd *et al.* 1997). Some of the best summaries that tie the capabilities approach to the field of knowledge management come from Teece *et al.* (1990), Teece and Pisano (1994) and Teece (1998). There are various studies that have examined “integrative capabilities” (Henderson, 1994; Iansiti, 1995; Rothwell and Whiston, 1998) and particularly those necessary for the flexible (re)combination of knowledge and expertise for innovation (Coombs, 1996; Leonard-Barton, 1995; Metcalfe and James, 1998). In innovation studies this has been referred to as the “interactive model” (Jones *et al.*, 1998).

### **5.2.3.3 Dynamic capabilities and this thesis.**

This thesis supports these arguments and as the innovation process is considered to be dynamic it also requires the culture it operates in to be the same. It therefore develops the notion of organisational culture as a repository of knowledge and proposes that the ability to respond to changing environments through the reconfiguration of its knowledge dynamics is an integral and vital dynamic capability that should be developed and built into an organisation.

## **5.3 Knowledge Management.**

This section starts by looking at knowledge-based organisations, followed by a detailed discussion on the three properties of knowledge: *types* of knowledge (the characteristics of knowledge), the *forms* of knowledge (a combination of the various characteristics to form categories), and the *nature* of knowledge (the behaviour of knowledge). Various combinations of these properties are referred to as “knowledge dynamics” and will be seen to have important implications to innovation capability in this thesis

### 5.3.1 Knowledge based firms.

Knowledge based firms are those that are staffed by a high proportion of highly qualified staff (Alvesson, 1993; Blackler, 1995; Starbuck, 1992, 1993). Knowledge staff are employees who apply theoretical and analytical knowledge to their jobs (Drucker, 1994; Janz *et al.* 1997). Knowledge firms are involved in research and development activities (Katz and Allen, 1985) are located in software or biotechnology (Brown and Duguid, 1998), consulting (Davenport and Prusak, 1998) and the pharmaceutical industries (Henderson and Cockburn, 1994). Firms in these knowledge-based industries generally have market values that are far greater than their conventional assets because of their ability to generate future returns from their stock and flow of intellectual capital. The ability of knowledge-based firms to outperform the marketplace rests on the continuous generation and synthesis of collective, organisational knowledge.

### 5.3.2 Knowing organisation versus knowledge organisation.

Chun, (1998), writing on knowledge management has put forward the idea of the “knowing organisation” rather than the often used term the “knowledge organisation”. This is an attempt to move away from the conceptualisation of knowledge as an object or thing that has to be acquired toward a broader view of “knowing” as an on going process of social construction and collective action that is embedded in organisational tasks, relationships and tools (Chun, 1998). This thesis considers knowledge as a dynamic resource found in the knowledge repository of organisational culture. It is also located in time and space and specific to particular contexts or what Blackler (1995) refers to as situated. Situated knowledge emphasises the significance of peoples’ interpretation of the contexts within which they act. Effective implementation of this resource results in organisational learning and a resultant change in organisational behaviour.

### 5.3.3 What is knowledge?

The vexed question of what is knowledge in terms of *form* and *type* is a good starting point in an attempt to develop the notion of the *nature* of knowledge as a dynamic resource that is enriched as the organisation uses and reuses it. This should include observations on the strategic value of knowledge. We are primarily concerned with knowledge in organisations that leads to innovation, knowledge that enables the development of new competencies, products and services and are also concerned with how new knowledge is acquired, converted and shared.



### 5.3.3.1 Types of knowledge - the characteristics of knowledge.

Nonaka and Takeuchi (1995) drawing on Polani's (1962, 1975) notion of tacit knowledge identify two types of knowledge: tacit and explicit. Tacit knowledge is embedded in the expertise and experience of individuals and groups and explicit or rule based knowledge is codified in organisational rules, routines and procedure. Following this classification, Chun (1998), proposes that knowledge in organisations can be differentiated into tacit, explicit and cultural knowledge. Cultural knowledge is discussed later in the chapter. Knowledge can also be individual and explicit, individual and tacit, collective and explicit, and collective and tacit. These characteristics of the different *types* of knowledge are used to form an understanding of the various *forms* of knowledge.

### 5.3.3.2 Forms – the categories of knowledge.

In organisational literature, five forms or categories of knowledge can be identified. This is an adaptation of a categorization suggested by Colilns (1993) to explain the psychological and behavioural aspects of knowledge and is based on the explicit- tacit and individual-collective dimensions.

<b>Blackler (1995)</b>	<b>Spender (1995,1996)</b>	<b>Bosoit (1995)</b>
Embrained knowledge Individual and explicit	Conscious knowledge Individual and explicit	
Embodied knowledge Individual and tacit	Automatic knowledge Individual and tacit	Personal knowledge Individual and tacit
Encultured knowledge Collective and explicit	Objectified knowledge Collective and explicit	Commonsense knowledge Collective and explicit
Embedded knowledge Collective and tacit		Proprietary knowledge Collective and tacit
Encoded knowledge Collective and explicit	Collective knowledge Collective and explicit	

**Table 5.1: The different forms of knowledge.**

The five categories are embrained, embodied, encultured, embedded and encoded and are fully explored by Blackler, (1995) who adapted them to describe the different “images” of knowledge within organisations. Blackler's terminology is retained in

this discussion but Table 5.1 provides a guide to other writers who have used a different type of topology.

*Embrained knowledge* (individual-explicit) is knowledge that is dependent upon conceptual skills and cognitive abilities (Blackler, 1995). Spender (1995, 1996) refers to this as conscious knowledge. It is abstract or theoretical knowledge. In western culture, abstract knowledge has enjoyed a privileged status, and a number of organisational commentators have emphasized its importance (Blackler 1995). Fiol and Lyles (1985), reflect the view of the distinctive status of abstract knowledge when they contrast “routine” behavioural adjustments which they term as “higher level” abilities to develop complex rules and understand complex causations. An example of this is in what Leonard-Barton (1994), calls empathic design especially in radical innovations which is based solely on the creative instincts of the designer by understanding the user needs through empathy with the user world. Argyris and Schon (1978) in their theory of “double loop” learning feature embrained knowledge and encourage an explicit recognition and reworking of taken-for-granted objectives. Senge (1990) also synthesizes personal insights, models, systems thinking and shared visions in a general account of organisational learning. Scientific knowledge, which focuses on the rational “understanding and knowing” of universal principles or laws of nature, belongs to this category (Blackler, 1995).

*Embodied knowledge (individual-tacit)* is action oriented and is likely to be only partly explicit (Blackler, 1995). It is the practical, individual type of knowledge on which Polani (1962, 1966) focused. Spender (1995) refers to this as automatic knowledge (preconscious individual knowledge). In contrast to embrained knowledge, which depends on abstract theoretical reasoning (knowing), embodied knowledge builds upon “bodily” or practical experience (doing) (Lam, 2000). It has a strong automatic and voluntaristic component and its generation and application does not need to be fitted into or processed through a conscious decision making schema (Spender, 1996). Boisot (1995) describes this as personal knowledge that is based on personal experience and is the basis of organisational knowledge. Describing embodied knowledge, Zuboff (1988) said such knowledge depended on people’s physical presence, on sentiment and sensory information, physical cues and face-to-face discussions. It is acquired by doing, and is rooted in specific contexts. Other accounts include Scibner’s (1986) description of “practical thinking”, i.e. problem-solving techniques which depend on an intimate knowledge of a situation rather than

abstract rules. According to Barley (1996), embodied knowledge is also context specific; it is “particular knowledge which becomes relevant only in light of the problem in hand”. Its generation cannot be separated from its application.

*Encultured knowledge (collective-explicit)* refers to the process of achieving shared understandings (Blackler, 1995). As in Boisot’s (1995) common-sense knowledge, cultural knowledge is uncodified and broadly diffused over the links and relationships that connect a group. Cultural knowledge is expressed in the assumptions, beliefs, and norms used by members to assign value and significance to new information or knowledge (Chun, 1998). Sackmann, (1991, 1992) identifies four kinds of cultural knowledge in organisations: dictionary, directory, recipe and axiomatic. Dictionary knowledge comprises of commonly held descriptions including expressions and definitions used in the organisation to describe the “what” of situations; directory knowledge refers to commonly held practices and is knowledge about sequences of events and their cause-effect relationships that describe the “how” of processes. Recipe knowledge comprises of prescriptions for repair and improvement strategies that recommend what action should be taken and axiomatic knowledge refers to the reasons and explanations for the actions and account for the “why”. Spender (1995) refers to this as “objectified” knowledge. According to Chun (1998) these cultural categories are related to the schemas, scripts and cause maps of groups. Cultural knowledge provides the pattern of shared assumptions (Schein, 1991) so that organisations can assign significance to new information and knowledge.

Blackler, (1995) argues that cultural meaning systems are intimately related to the process of socialization and acculturation and such understandings are likely to be dependent on language, socially constructed and open to negotiation. Pettigrew (1979) and Ouchi’s (1980) discussion on organisational culture has also raised interest in the relevance to organisations of such processes and Leonard-Barton (1995) has shown that cultural knowledge supplies values and norms that determine what type of knowledge is sought.

*Embedded knowledge (collective form of tacit knowledge)* is knowledge that resides in systemic (organisational) routines and shared norms (Blackler 1995). The concept of social embeddedness refers to how institutions are affected by networks of social relations (Granovetter, 1985). Granovetter proposes a theory of economic action that would neither be heavily dependent on the notion of culture (be over-socialized) nor heavily dependent on theories of the market (under-socialized) and introduced the

notion of “embeddedness”. His idea was that economic behaviour is intimately related to social and institutional arrangements. It is this Durkheimian type of knowledge within an organisation that makes communication possible and is rooted in an organisation’s community of practice, by Duguid (1991) to denote the socially constructed and interactive nature of learning. Following Badaracco (1991), the notion of embedded knowledge explores the significance of relationships and material resources. An understanding of existing markets (relationships and resources) comes from proactive approaches but in new markets comes from a tacit understanding of user needs driven by gut feeling or experience (Maidique and Zirger 1985). Embedded knowledge is analysable in systems terms, in the relationships between technologies, roles, formal procedures and emergent routines. Boisot (1995) refers to this as proprietary knowledge, which is knowledge that is unique to the organisation and which it has developed in response to its specific circumstances. In addition to the physical and mental factors that comprise individual skills, organisational skills are made up of a complex mix of interpersonal, technological and socio-structural factors. Embedded knowledge is relation specific, contextual and dispersed (Blackler, 1995). It is organic and dynamic, an emergent form of knowledge capable of supporting complex patterns of interaction in the absence of written rules. Levitt and March (1988) develop the notion of organisational routines which they suggest make the lessons of history accessible to subsequent organisational members. Prahalad and Hamel, (1990) write about organisational competencies and Henderson and Clark (1990) distinguish between component knowledge (knowledge of specialist elements in an organisation) and architectural knowledge (knowledge about how such elements interact). Architectural knowledge is submerged within the organisation’s taken-for-granted routines and interactions, yet is central to an understanding of its strengths and weaknesses.

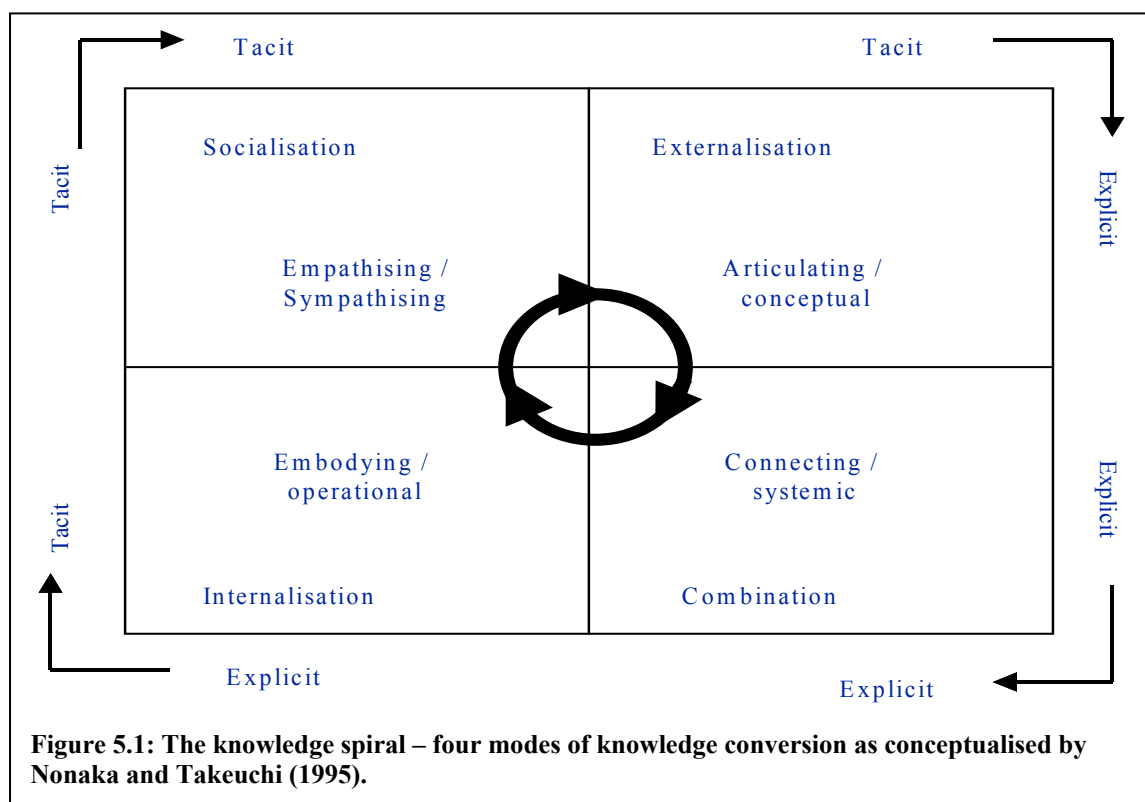
*Encoded knowledge, (collective-explicit)* is information conveyed by signs and symbols. To the traditional forms of encoded knowledge, such as books, manuals and codes of practice, has been added information encoded and transmitted electronically (Blackler, 1995). It tends to generate a unified and predictable pattern of behaviour and output in organisations. This is similar to Spender’s (1995, 1996) collective knowledge (text dependent knowledge that is manifested in the practice of the organisation). Zuboff’s (1988) analysis of the “informating” power of information

technologies explores the significance of this point for organisations. Information encoded by decontextualized abstract symbols is highly selective in its representation.

### 5.3.3.3 The nature of knowledge - knowledge conversion, building and linking.

New knowledge is created through knowledge conversion (Nonaka and Takeuchi 1995), knowledge building (Leonard-Barton, 1995), and knowledge linking (Badarocco 1991; Wikstrom and Normann 1994).

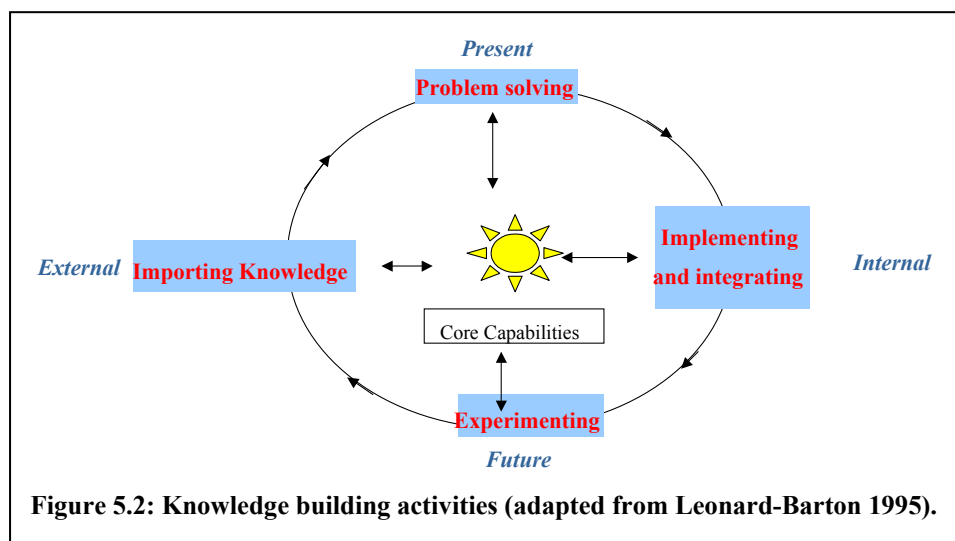
In *knowledge conversion* (Nonaka and Takeuchi, 1995), the organisation continuously creates new knowledge by converting between the personal, tacit knowledge of individuals who produce creative insight, and the shared explicit knowledge, which the organisation needs to develop new products and innovations (Figure 5.1).



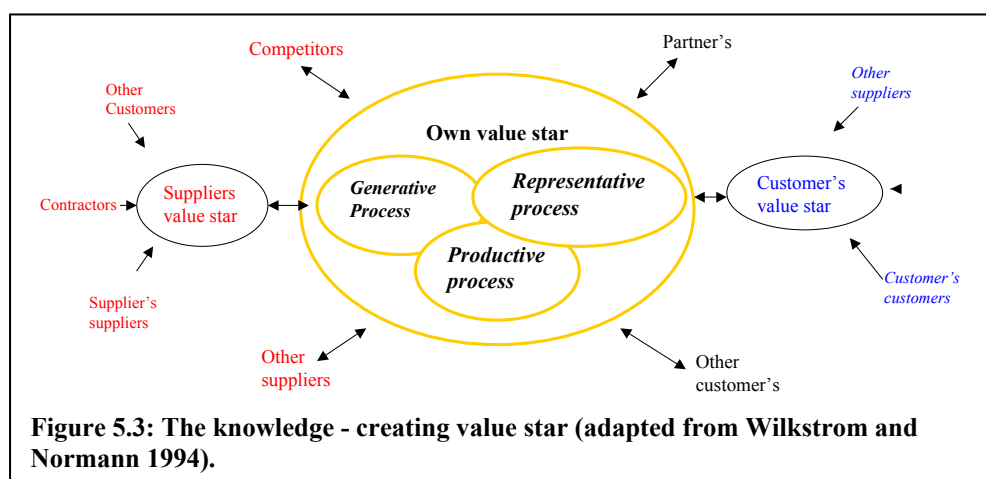
Tacit knowledge is shared and externalised through dialogue that uses metaphors and analogies. New concepts are created, and the concepts are justified and evaluated according to their fit with organisational intent. Concepts are tested and elaborated by building archetypes or prototypes. Finally, concepts, which have been created, justified, and modelled, are moved to other levels of the organisation to spark new cycles of knowledge creation.

In *knowledge building* (Leonard-Barton 1995) the organisation identifies and nurtures activities that build upon knowledge and strengthen its distinctive core capabilities, enabling them to grow over time (Figure 5.2). These knowledge-building activities

are shared problem solving, experimenting and prototyping, implementing and integrating new processes and tools, and importing knowledge and individuals with diverse signature skills to work together on solving a problem. Through experimentation and prototyping, the organisation extends its existing capabilities and builds new ones for the future. Successful implementation of new tools and processes requires users and technology to mutually adapt and to complement each other. Knowledge about the technology as well as the market is imported from outside the organisation and absorbed.



In *knowledge linking* (Badaracco, 1991), the organisation forms intimate learning alliances with other organisations in order to transfer knowledge that is situated in specialized relationships, work cultures, and operating styles of the partner organisation. Wikstrom and Normann (1994) view an organisation as a knowledge creating value star at the centre of many incoming flows of knowledge from suppliers, customers, and other partners (Figure 5.3).



Knowledge is transferred into value not only within organisations, but also through these knowledge-based interactions.

Knowledge can be seen as an abundant resource that can be created, multiplied, transferred, assimilated, traded, shared, changed from one form to another and can flow and be transmitted within and between both individuals and organisations. Even firms that do not appreciate that their knowledge needs change, as is often the case with mature industries or those organisations that rely little on innovation, recognize the need for knowledge strategies. These must provide organisations with the strategic ability to acquire, create, exploit, and accumulate new knowledge continuously and repeatedly in a cyclical manner.

<b>Knowledge linking</b> <i>Wikstrom, Normann (1994)</i>	<b>Knowledge Conversion</b> <i>Nonaka, Takeuci (1995)</i>	<b>Knowledge Building</b> <i>Leonard – Barton (1995)</i>
<b>Generative processes</b> <i>Generating new knowledge</i>	<i>Sharing Tacit knowledge</i> Ø “Socialization” <i>Tacit to Tacit</i>	<i>Shared problem solving</i>
	<b>Creating Concepts</b> Ø “Externalization” <i>Tacit to Explicit</i>	<i>Experimenting and prototyping</i>
<b>Productive processes</b> <i>Operationalizing new knowledge</i>	<i>Justifying concepts</i>	<i>Implementing and integrating new processes and tools</i>
	<b>Building Archetypes</b> Ø “Combination” <i>Explicit to explicit</i>	
<b>Representative processes</b> <i>Diffusing, transferring new knowledge</i>	<b>Cross – Leveling Knowledge</b> Ø “Internalization” <i>(Explicit to tacit)</i>	<i>Importing Knowledge</i>

**Table 5.2: Comparison of knowledge creating processes (adapted from Chun, 1998).**

Table 5.2 provides a comparison of these three types of knowledge creating processes.

#### 5.3.3.4 Knowledge and innovation.

Veron (1999) distinguishes capabilities according to the type of knowledge they contain. Functional capabilities allow a firm to develop its technical knowledge (Amit and Schoemaker, 1993; Pisano, 1997; Prahalad and Hamel 1990). Integrative capabilities allow firms to absorb knowledge from external sources and blend the different technical competencies developed in various company departments (Cohen and Levinthal, 1990; Grant, 1996; Henderson and Clark, 1990; Kogut and Zander,

1992; Pisano, 1997). Fuchs *et al.* (2000), develop the concept of a higher order integration capability. Organisations possessing this innovation capability have the ability to integrate their key capabilities and resources to stimulate innovation. It is often difficult to identify which of the many organisational resources that individually or collectively account for effective performance. The tracing and identification of these general processes is still in its formative stages (Leonard–Barton, 1995; Teece and Pisano, 1994). Without an understanding of the specific activities that underlie capabilities, study replication and knowledge development in the area is difficult (Petraf, 1993). The value of resources may change over time becoming a “core rigidity” of the organisation, even when the resource itself has not changed form (Leonard- Barton, 1995).

#### **5.4 Organisational learning.**

Organisational learning attempts to describe how an organisation learns. The best-known definitions are based on potential or actual change in behaviour or action. Argyris and Schon (1978) describe organisational learning as experience-based improvement in organisational task performance. March and Olsen (1976) state that it is the process by which members of the dominant coalition in an organisation develop, over time, the ability to discover when organisational changes are required and what changes can be undertaken with likely success. The ability to adapt organisational culture by reconfiguring its attributes and organisational learning is a key capability that is central to the findings of this study. Essentially, learning can be seen to have occurred when organisations perform in changed and better ways.

##### **5.4.1 Levels of learning: the operational and conceptual.**

The 10<sup>th</sup> edition of the Concise Oxford (1999, pp 808) dictionary states that learning is “the acquiring of new knowledge or skill”. Thus learning encompasses two meanings (Kim, 1993). First is the acquisition of skill or *know-how*, which implies the physical ability to produce some action, and secondly the acquisition of *know-why*, which implies the ability to articulate a conceptual understanding of an experience. It is useful to distinguish between learning “how” and learning “why” (Edmonson and Moingeon, 1996). Learning “how” involves improving or transferring existing skills, whereas learning “why” aims to understand the underlying logic or causal factors, with a view of applying knowledge in new contexts. Neither form of learning is inherently superior and each will be important in differing circumstances.



### **5.4.2 Individual and organisational learning.**

Much of the research into technology management and organisational change has failed to address the issue of organisational learning, and has instead focused on learning by individuals within organisations. It is important to recognise that organisations do not learn, but rather the people in them do (Bessant *et al.* 1996). Three distinctive levels of organisational learning can be identified: knowledge acquisition; information distribution, and organisational memory (Huber, 1996b).

### **5.4.3 The learning organisation.**

The idea of a “learning organisation” is a recognition of, and response to, the limits of individual learning. Although it can and does occur accidentally, organisations cannot afford to rely on learning through chance (Dixon, 1994). Organisational learning is only effective when it results in behavioural change, and there can be no learning without action and no action without learning (Revans, 1998). Adaptation is, therefore achieved only through learning and learning can only emerge from adaptation. Organisational learning cannot occur solely through the acquisition of new-programmed knowledge, no matter how important that knowledge might be. It is a long-term initiative that involves sound managerial practice and processes that requires an organisation to be skilled at creating, acquiring and transferring knowledge and the capability to modify its culture to reflect the related skills and ideas. The key to a learning organisation is the empowerment of employees to make decisions based on the knowledge and skills that they acquire and this necessitates trust (Newell and Swan, 2000).

The learning organisation exists only in the sense of a complex set of practices, systems and relationships which link the organisation’s vision, mission, values and behaviour to desired outcomes and results. An effective learning organisation constantly questions its assumptions and reviews its objectives in the light of its own experience and changes in the external environment. It is about being flexible and being in the right place at the right time to take full advantage of change and the opportunities it brings. Pedlar *et.al.* (1997) proposed a three-stage process of developing “consciousness” in organisations:

1. Surviving – here the organisation forms habits and processes that enable it to carry out the basic task and to deal with any problems in a fire-fighting way.
2. Adapting – here the organisation continuously adapts its habits and procedures, and changes in response to environment trends and forecasts.

3. Sustaining – here the organisation seeks to contribute to as well as to gain advantage from its contexts, aiming for a mutual and sustainable relationship with its environment.

The key to the learning organisation lies in the ability and willingness of people to innovate. The speed and effectiveness with which new practice and innovation can spread throughout the organisation is crucial. Ulrich (1994) has suggested that the organisational learning capability can be expressed as  $OLC = I + G$

Where:

OLC = Organisational Learning Capability.

I = ability to innovate.

G = ability to generalise this learning into good practice throughout the organisation.

Being able to innovate depends upon the quality of the people and how good they are at learning and development. Generalising good ideas quickly throughout the organisation depends on the effectiveness of communications systems and on the willingness of people to share and exchange ideas.

#### **5.4.4 The learning organisation and knowledge management.**

The concept of the *learning organisation* has become the short hand for an organisation that is skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights (Garvin, 1993). The learning organisation describes a particular type of enterprise and prescribes principles that will enable the firm to successfully adapt to changes in the business environment (Tsang, 1997). Pedler *et al.* (1991) state that an organisation that facilitates the learning of all its members and continuously transforms itself can be referred to as a learning organisation. Senge (1994) argues that a learning organisation continually expands its capacity to create its future. He asserts that five disciplines or practices: personal mastery, mental models, team learning, building shared vision, and systems thinking are essential to building a learning organisation. The concepts of the learning organisation and knowledge management thus become inseparable.

#### **5.4.5 Characteristics of a learning organisation.**

The learning organisation exists only in the sense of a complex set of practices, systems and relationships which link the organisation's vision, mission, values and behaviour to desired outcomes and results. An effective learning organisation will constantly question its assumptions and review its objectives in the light of its own

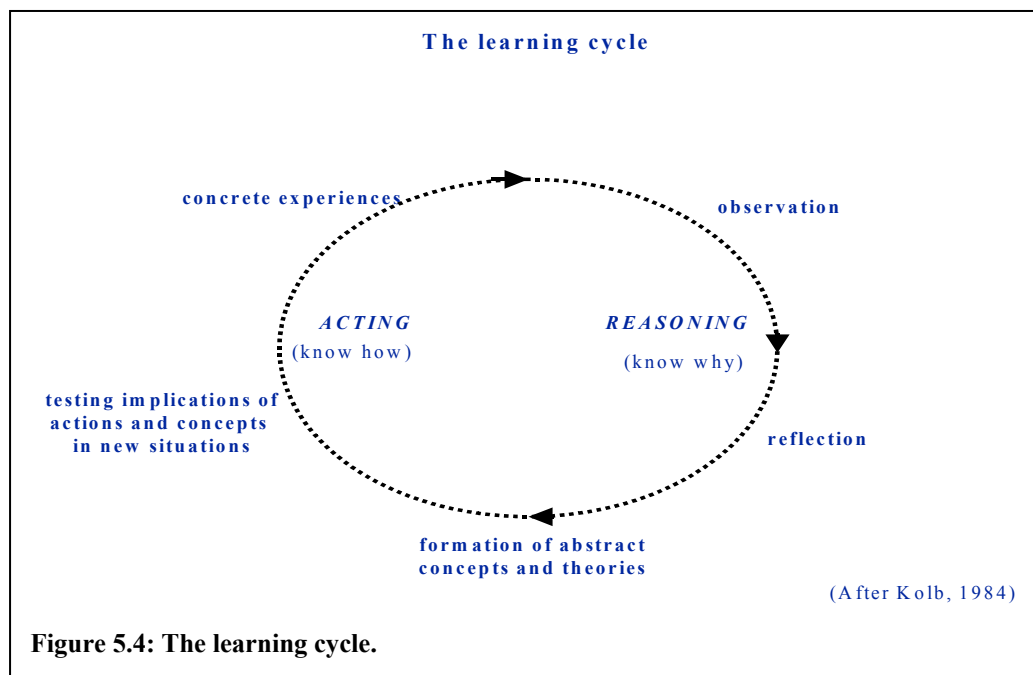
experience and changes in the external environment. In Pedler *et al*'s (1991) vision, the learning organisation has eleven key characteristics.

1. A learning approach to strategy (encouraging flexibility by including strategic learning feedback loops) – where policy and strategy formulation are consciously structured for learning, for example, deliberate pilots and small scale experiments are used to create feed-back loops for learning about direction and the formulation of “emergent strategy”.
2. Participative policymaking – where all members of the organisation together with key stakeholders have a chance to contribute and participate in policy making.
3. “Informating” (using information technology to inform and empower people) – in the learning company information technology is used not just to automate, but to make information widely available to front-line staff in order to empower them to act on their own initiative.
4. Formative accounting and control (structuring financial systems to assist learning) – this is a particular aspect of *Informating*, where systems of budgeting reporting and accounting are structured to assist learning for all members about how money works in the business.
5. Internal exchange (ensuring constructive, supportive relationships within the organisation) – where there is a high degree of *Internal Exchange*, all internal units and departments see themselves as customers and suppliers in a supply chain to the end user or client; contracting with and learning from other departments is normal.
6. Reward flexibility (using creativity in how people are rewarded for good performance) – with greater participation comes a need for more flexible and creative rewards. High reward flexibility means that there are alternatives in both monetary and non-monetary rewards to cater for individual needs and performance.
7. Enabling structures (avoiding multi-level hierarchies and encouraging flattened, collegiate-style structures) – roles, departments, organisation charts and even procedures and processes are seen as temporary structures that can be easily changed to meet job, user or innovation requirements.
8. Boundary workers as environmental scanners (acknowledging the value of those who deal with the ‘outside world’ as sources of crucial information

which can inform decision-making) - environmental scanning is carried out by all people who have contacts with external users, customers, suppliers, clients, business partners, neighbours, and so on. Processes are in place for bringing back and welcoming information into the company.

9. Inter-organisational learning (identifying opportunities for networking, strategic partnerships, benchmarking and joint learning activities) – through joint ventures and other learning alliances. The organisation learns from other companies and meets with them for mutual exchange.
10. Learning climate (facilitating experimentation and allowing mistakes providing they are used as learning opportunities) – in the learning company all managers see their primary task as facilitating company members' experimentation and learning from experience, through questioning, feedback and support. The company seeks to export this *learning climate* to its context and business partners.
11. Self-development for all (resources and encouragement for self-development are made available for all members of the organisation) – especially those in the front line with users or clients. People are encouraged to take responsibility for their own learning and development.

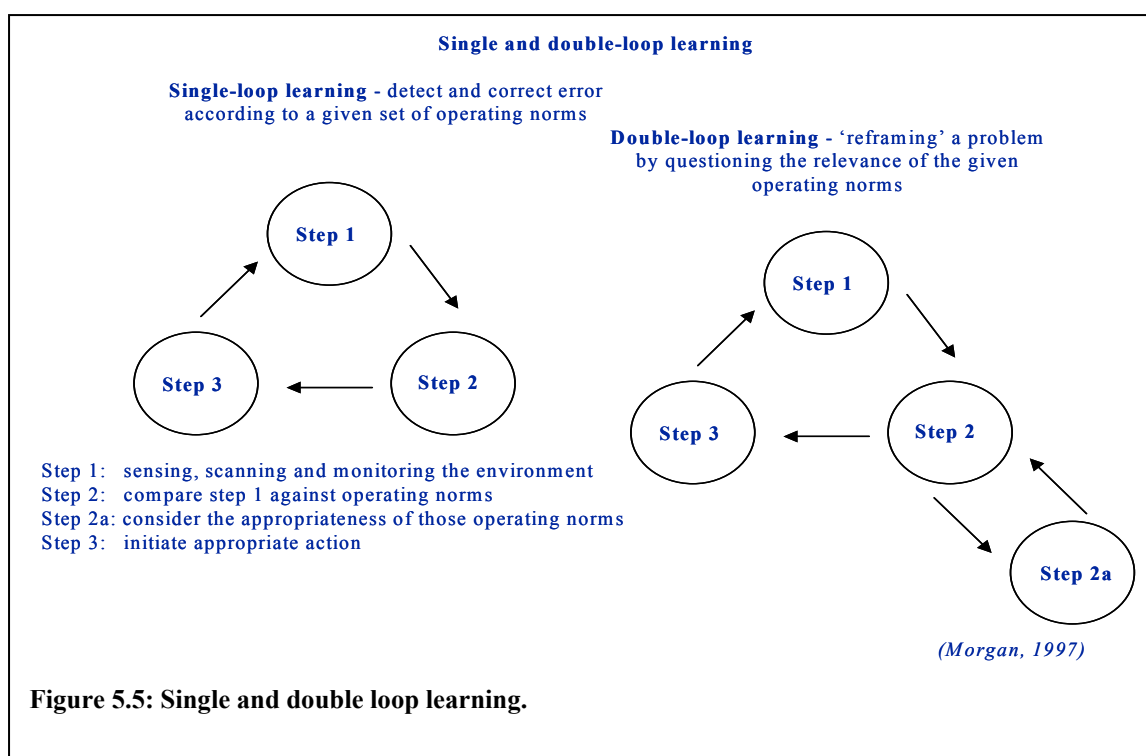
#### 5.4.6 Models of organisational learning.



Kolb (1984) - see Figure 5.4, developed the most recognized model of experiential learning, which he described as a cyclical process starting with a concrete experience,

reflection, and multiple perspectives, especially with past associations. The individual integrates these perspectives forming an abstract conceptualisation, which then forms the basis of action. This starts another cycle, as action eventually produces a consequence, another event for reflection, interpretation and action. Kolb also described individual characteristics or abilities that are required for progression through the model. These included a willingness to engage in new experiences, reflective skills, the ability to view experience from diverse perspectives, analytical abilities and decision making or problem solving skills.

Argyris and Schon (1978) use an adaptation of the learning cycle to describe single loop learning, which involves the detection and correction of error (Figure 5.5). In single-loop learning, the organisation improves its efficiency through reflection on previous experiences and incrementally becoming better at dealing with a prescribed problem or environmental situation.



Argyris and Schon also develop the concepts of double-loop and deuterio-learning. Double-loop learning occurs when error is detected and corrected in ways that involve modification of an organisation's underlying norms, policies and objectives. This is achieved through a critical examination of the espoused theory, expressed mental model, and in comparison with actual behaviour. Double loop learning is proposed as a means to create and sustain a culture that supports learning at the individual, group and organisational levels. Deuterio-learning occurs when organisations learn how to

carry out single-loop and double-loop learning. The first two forms of learning will not occur if the organisation is not aware that learning must occur. Argyris and Schon (1978) found that most organisations are quite successful at single-loop learning, have great difficulty with double-loop learning and found no examples of organisations engaged in deutero-learning. Senge (1994) refers to this same type of process as adaptive learning, which focuses on solving problems in the present, without examining the appropriateness of current learning behaviours. The fundamental assumptions underlying the existing ways of doing work remain unquestioned.

#### **5.4.7 Organisational learning and the thesis.**

The characteristics of the learning organisation and the models of organisational learning reinforce the argument presented in section 5.4.4 where the concepts of the learning organisation and knowledge management were considered as inseparable. This argument links back to the specific aims and objectives presented in section 1.4.2 where the concepts of knowledge dynamics are central to the development of a conceptual model of organisational culture that would contribute to improving innovative capability. This dynamic interaction and the inseparability of knowledge management from organisational learning thus become central to the approach adopted in this study for understanding and managing innovation capability.

### **5.5 Systems approach.**

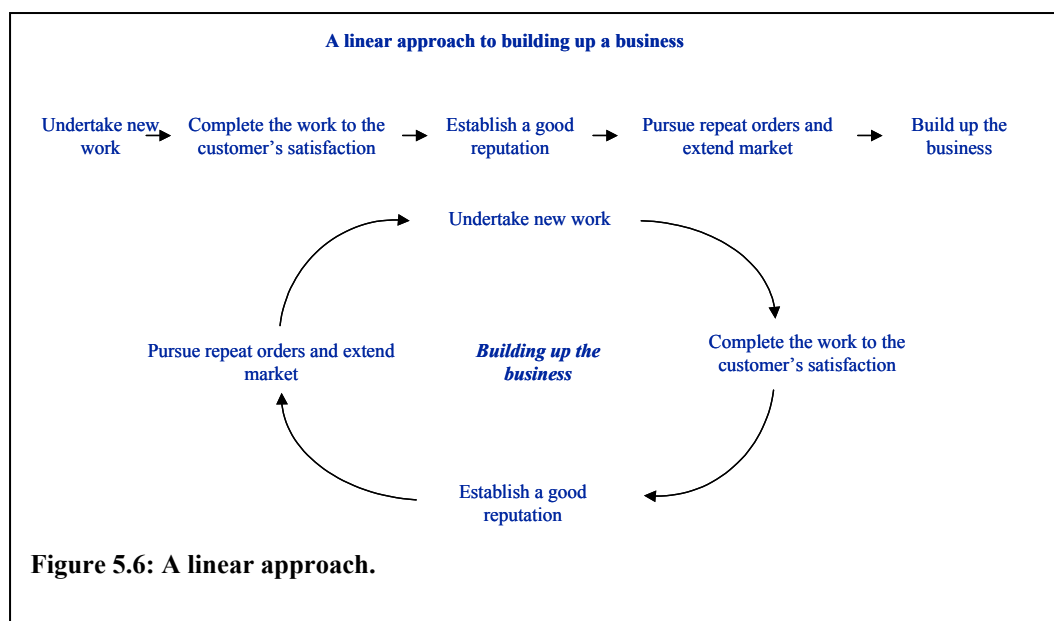
This section begins by taking a look at General Systems Theory and then compares this with the traditional linear approach. The notion of systems thinking as a tool for studying complex and dynamic phenomena is then discussed in detail followed by an introduction to Soft Systems Thinking. Various methodologies and tools of systems' thinking are then presented. This section concludes by describing the "Limits to Growth" archetype which is later developed along with other cultural archetypes.

#### **5.5.1 General Systems Theory.**

General systems theory was introduced in the 1940's by Ludwig von Bertalanffy (as cited in Cummins, 1980) but has been vastly expanded since its inception. His initial premise was that there are fundamental structures which act across all branches of science. As these structures were learnt, insights relating to them could be transferred from one discipline to another. This was the foundation of what was to become General Systems Teaching, but ended up being called General Systems Theory due to a translation error.

### 5.5.2 Traditional versus a systems thinking approach.

Traditional analysis focuses on separating the individual components of what is being studied. Indeed the word "analysis" actually comes from the root meaning "to break into constituent parts" – see example in Figure 5.6. Systems' thinking is a radical departure from traditional science that focused upon the relationships between cause and effect. Descartes and Bacon provided an analytic framework for understanding referred to as the scientific method while Newton, with his discoveries of the laws of motion and gravity, provided a clockwork paradigm for understanding the universe. The Newtonian paradigm essentially embodies a linear cause and effect relationship. The difficulty with this paradigm was that it provided a very limited short-term perspective for understanding how things really worked. By moving beyond the linear cause and effect paradigm, a deeper understanding of the way things operate can be achieved through an appreciation of systemic interrelationships.



Systems thinking developed as a response to the rapid technological complexities that confronted engineering and science. It focuses on how the objects or processes under study interact with the other constituents of the system—a set of elements that interact to produce behaviour. This results in sometimes strikingly different conclusions than those generated by traditional forms of analysis, especially when what is being studied is dynamic, complex or has a great deal of feedback from other sources, internal or external.

### **5.5.3 The definition of a system.**

A system is an entity that maintains its existence through the mutual interaction of its parts (Billinger, 2001). The key part of this definition is that of interaction. It is the interactions not the parts that are responsible for the characteristics of the system.

### **5.5.4 Systems thinking as a tool.**

Systems' thinking is fast becoming a powerful tool in support of decision-making and organisational change. Senge (1990, pp.73) defines its essence as a shift of mind to: (a) seeing interrelationships rather than linear cause-effect chains, and (b) seeing processes of change rather than snapshots. According to him, most systems analysis focuses on detail, not dynamic complexity. This is a pivotal point in organisational analysis and planning. Kim (1993) relates a basic hypothesis proposed by Simon (1981), who suggested that although a man, viewed as a behaving system, is quite simple, the apparent complexity of his behaviour over time is largely a reflection of the complexity of his environment. In this approach the organisation and all of its individual players are concerned in the context of their environment(s) which is a complex whole of interrelating, interdependent parts. Systems' thinking stresses the relationships and the processes that make up the organisational context, rather than the separate entities or the sum of the parts (Cummings, 1980). Jay Forrester in the 1960's developed a branch of systems thinking which focused on organisational change. This led to the development of the field of system dynamics (Senge, *et al.* 1994) and within these multiple dynamic system the organisation can be viewed as a "learning system" (Nevis, *et al.* 1995).

### **5.5.5 Systems thinking and soft systems.**

Checkland (as cited in Richardson, 1991) described the purposeful activity of human beings as "human activity" systems that include organisations, industrial activity, and political systems. These kinds of system are referred to as soft systems and are usually described by language other than mathematical modelling. Systems' thinking often involves building models to facilitate understanding and communication at the level of both the individual and the larger group or team. As individuals we all view the world differently since we are conditioned over time by our cultural traditions, personal experiences and education. While such diversity has a latent value, it can also be the source of misunderstandings and increased complexity in our social systems because of the assumptions we unwittingly make in our communication with fellow workers and citizens. This refers to the 'soft' issues of the work place; the



complex web of value systems and the understanding of human relationships that forms the 'real' organisation, i.e. social systems. Social systems describe people in organisations, in the public and private sectors, communities of people living and working together in a shared environment. People in social systems are observers of the system and they engage in conversations through the use of a shared language. Organisational systems will have control mechanisms (processes), which act within certain boundaries or areas of responsibility. There will invariably be processes of measurement so that appropriate decisions can be made to meet objectives. Finally, a "human activity" system will be part of a systems hierarchy, a subsystem within a greater system, or a larger system incorporating smaller subsystems within itself (Wilson, 1984).

#### **5.5.6 Examples of use of systems' thinking tools.**

Systems thinking has given companies a tool, which can assist them in coping with constant change. It allows individuals to see processes over time and to break away from their assumptions and has been used in combination with other organisational change strategies (Gardner and Demello, 1993). One such organisational change is often called re-engineering and is not simply an elimination process to gain productivity. Unlike downsizing or restructuring, re-engineering requires a re-evaluation of assumptions and beliefs about processes, systems, structure, people, culture, practices, and technologies (Moravec, 1995). This rethinking of mental models requires a working knowledge of systems thinking. Reengineering always requires action at the systems level and involves breaking down a system that appears in many cases to be working, and examining the socio-technical system or corporate culture (Allee, 1995).

Another type of change that organisations are undertaking is systems integration. It does not entail the revamping of every aspect of a company, but rather seeks to synchronize processes that share a natural relationship to a common goal (Cavaleri and Fearon, 1994). Encouraging innovation in work processes is the central purpose of integrating systems. This work improvement strategy focuses on improving these relationships, whether they are technical or human and systems thinking can be employed to bring about this type of integration, through improved socio-technical interaction.

## **5.6 Methodologies and tools of systems thinking.**

Comprehending and acknowledging the theoretical underpinnings for systems thinking is necessary in order to develop methodologies and tools, which are transformative, and able to change how we think. Forrester (as cited in Richardson, 1991) is credited with demonstrating how feedback processes can generate the patterns of behaviour seen in large organisations (Senge *et al.* 1994). The concept of feedback loops help explain some of the changes that occur within complex systems. Forrester defined a complex system as a high-order, multiple-loop, non-linear feedback structure where feedback loops were seen as a major source of behavioural and policy difficulties. Patterns of behaviour can be detected in feedback structures and the difficulty with comprehending and handling complex systems results directly from their multi-loop structure.

The system dynamics' thinker tries to see how these feedback loops contribute to different organisational behaviours (Richardson, 1991). Feedback loops are given various labels, from causal loops to reinforcing or balancing loops. These loops represent cause and effect relationships among the elements in the loops. A change in one part of the loop will result in changes in the other parts (Senge *et al.* 1994). Feedback loops often compensate for changes that are imposed on the system. This refers to the adjustments that elements within the loop make to counteract the direction of the change (Richardson, 1991). For systems thinking to become a reality for every employee, it must be expressed in terms that are understandable and usable. The next section looks at some of the methodologies and tools that might facilitate this.

### **5.6.1 Systems' Modelling.**

Systems' modelling has become an effective tool to help build systems thinking into practice. It provides a practical framework from which to approach changes in organisational processes. Analyses of processes should take into consideration both space and time, so systems modelling combines process mapping and simulation. Process mapping tends to provide a rather static look at organisational behaviour and to reveal consequences when changes are made within any elements in the system, while simulation observes behaviour over time with the idea of process re-design in mind (Wolstenholme and Stevenson, 1994). A typical visual output of system thinking approaches is a model or series of models, which attempts to explain the workings of the system under investigation. Accepting that there is generally no

single, linear cause and effect sequence, the value of these models lies in their ability to help view complexity from the position of numerous interlinked cause and effect situations. As a consequence, the unintended effects of actions or strategies, which are often counter-intuitive, can be perceived. This is frequently the source of significant personal and organisational learning brought about by the sharing of mental models.

Process mapping is usually one of the first things undertaken when laying out the total system. It shows both the external and internal boundaries and interdependencies, along with important linkages, and gives management an opportunity to share mental models and test assumptions. Some frequently used mapping techniques are stock-and-flow maps, interrelationship digraphs, and macro flow charts (Wolstenholme and Stevenson, 1994).

### **5.6.2 Simulation.**

Simulation takes process mapping one step further. It may not require the use of sophisticated computer software, but software programs such as 'ithink', while not requiring programming skills, do make it easier to see the implications of change over time. It is essential to explore the potential impacts of process changes before they are implemented and systems' modelling provides management with the necessary tools to do this (Wolstenholme and Stevenson, 1994).

Simulation has been discussed as a tool to view specific organisational environments, but it can also be used to teach systems thinking itself. Some simulations involve the use of computers, while others are behavioural in nature, requiring the participants to act out a scenario. These behavioural simulations create a micro world within which participants can interact with a whole range of business issues. These types of simulations provide a practice field where developing managers can apply systems thinking. Behavioural simulations differ from computer simulations in that individual or group efforts can be examined as if in a managerial work context (Stumpf and Watson, 1994). One such behavioural simulation game is the Beer Distribution Game developed at MIT (Senge, 1990).

### **5.6.3 Scenario planning.**

Strategic planning is nothing new to corporate executives, but it attempts to forecast important business variables with the assumptions and mental models used in the present. Scenario planning is a tool that enables people to break out of this mind set and imagine different possible futures. In order to implement scenario planning,

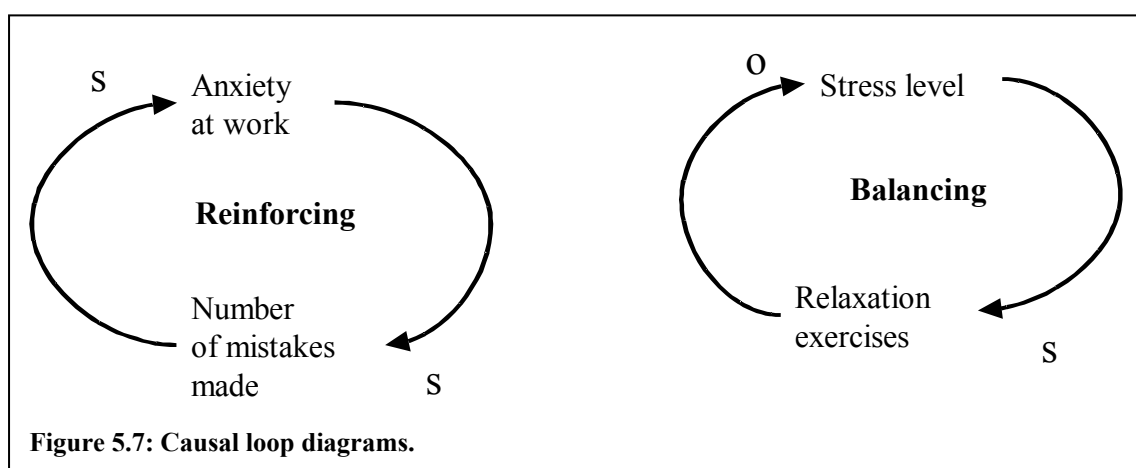
systems thinking must be employed. Organisations need to look at all the changing interrelationships and uncertainties that will be a part of future working environments. Royal Dutch/Shell is one of the companies that has made good use of scenario planning. Through careful research they foresaw the energy crisis of the 1970's and were able to prepare some "just in case" strategies that propelled Shell to the top of the list of most profitable oil companies. In the 1980's Shell also used scenario planning to anticipate the reform movement that took place in Russia (Schwartz, 1991).

#### **5.6.4 Causal loops.**

One of the original structures used by systems thinkers to view the interrelationships of the organisation is the causal loop. Human social systems - including organisations - can seem complicated. However, they are really made up of just two kinds of building blocks - reinforcing and balancing processes. Reinforcing processes create exponential growth and collapse. The reinforcing loop depicts in graphic representation either growth or decline that occurs at an ever-increasing pace. Every variable that is shown is either a cause or effect of some other variable, forming a cycle. If a reinforcing loop refers to exponential growth for the company, it may be referred to as a virtuous cycle, but if decline is represented, the loop is a vicious cycle (Senge *et al.* 1994). This type of growth or collapse cannot continue indefinitely. There will always be something that limits it. This is known as a balancing loop. Aside from its limiting function, the balancing loop can also provide equilibrium to those forces that may seem out of control. A system or process will find this equilibrium or resistance when it hits a certain goal or constraint which may not be known at first. Recognizing this constraint or goal (Senge, 1994) and setting a new goal may help to overcome the limiting factor. Balancing processes keep a situation at equilibrium. It takes place in organisations where it is hard to make a change, or when a company's sudden growth seems to hit a plateau. The combinations of reinforcing and balancing processes within a system cause its complex and sometimes baffling behaviour. In neither of the two types of causal loops can the variables be expected to proceed at an even and predictable pace. There are often delays that may result in wasted resources or energy if they are not recognized and accounted for. Causal loops may become extremely complicated making it difficult to wade through the details to find the source of problems. These are discussed next.

#### 5.6.4.1 Causal loop diagrams.

Causal loop diagrams (CLDs) are a kind of systems thinking tool (Pegasus Communication). These diagrams consist of arrows connecting variables (things that change over time) in a way that shows how one variable affects another – see Figure 5.7. Each arrow in a causal loop diagram is labelled with an "S" or an "O". The "S" means that when the first variable changes, the second one changes in the same direction (for example, as your anxiety at work goes up, the number of mistakes you make goes up, too).



"O" means that the first variable causes a change in the opposite direction in the second variable (for example, the more relaxation exercises you do, the less stressed you feel). In CLDs, the arrows come together to form loops, and each loop is labelled with an "R" or a "B." "R" means reinforcing; i.e., the causal relationships within the loop create exponential growth or collapse. For instance, the more anxious you are at work, the more mistakes you make, and as you make more mistakes, you get even more anxious, and so on, in a vicious, upward spiral. "B" means balancing; i.e. the causal influences in the loop keep things in equilibrium. For example, if you feel more stressed, you do more relaxation exercises, which bring your stress level down. CLDs can contain many different "R" and "B" loops, all connected together with arrows. Another way of representing the reinforcing and balancing loops is through the use of two symbols that are depicted in Figure 5 8, first used by Senge (1990).

By drawing these diagrams, a rich array of perspectives on what is happening in an organisation can be obtained. Ways to make changes so as to improve things can then be identified. For example, by understanding the connection between anxiety and mistakes, ways to reduce anxiety in an organisation need to be found.

When a reinforcing structure produces a desirable result it is generally referred to as a *virtuous* cycle. When this happens there is a tendency to ignore it and let it go. This is a mistake, as nothing grows forever. When everything is going just the way it is wanted, that is the best time to be concerned about how to ensure it continues going that way. When a reinforcing structure produces an undesirable result it is generally referred to as a *viscous* cycle. The best way to deal with a viscous cycle is to find a way to break one of the feedback loops so the structure can no longer reinforce itself. The reinforcing structure seldom occurs in isolation from additional influences. As was indicated above, nothing grows forever so there are extensions of this structure to be concerned about and the most prevalent are identified below. Within a reinforcing structure there are often *limits to growth*, which have not yet kicked in and it is best to look for these before running into them (Senge, 1990).

The desired state interacts with the current state to produce a gap with the former remaining fixed during this deliberation (Billinger, 2001). For example the difference in the current and ideal weight is the “gap” for a person trying to lose weight. This is really the motivation for action with the larger the gap the greater the tendency for behavioural change. The action taken then alters the current state (for example going on a diet and exercising). When the action succeeds in moving the current state to a point where it is equal to the desired state the gap is reduced to zero and there is no more motivation for action. It is also important to note that there may be delays, possibly of different durations, associated with the interactions between the parts of a system (for example Christmas parties or holidays). These delays will determine the length of time it takes for the characteristics of the structure to become evident. When dealing with intricate combinations of balancing and reinforcing structures delays are responsible for creating characteristics that are very non-linear and often very counter-intuitive.

### **5.6.5 Archetypes.**

*Systems archetypes* are a class of systems thinking tool for capturing common challenges that occur in all kinds of industries and organisations. The archetypes themselves consist of causal loops depicting typical and problematic systemic structures. These consist of balancing and reinforcing structures that can be considered as building blocks of systems archetypes, and can be combined in numerous ways to describe more intricate interactions. The reinforcing and balancing structures represent the first two of a set of structures postulated by Ludwig von

Bertalanffy in the 1930s. These were developed and finally labelled as Archetypes by Peter Senge in his 1990 work entitled "The Fifth Discipline: The Art and Practice of the Learning Organisation." Descartes, Newton, Bertalanffy, Wiener, Bateson, and Forrester had evolved our understanding of systems archetypes to this point.

#### **5.6.5.1 Use of archetypes.**

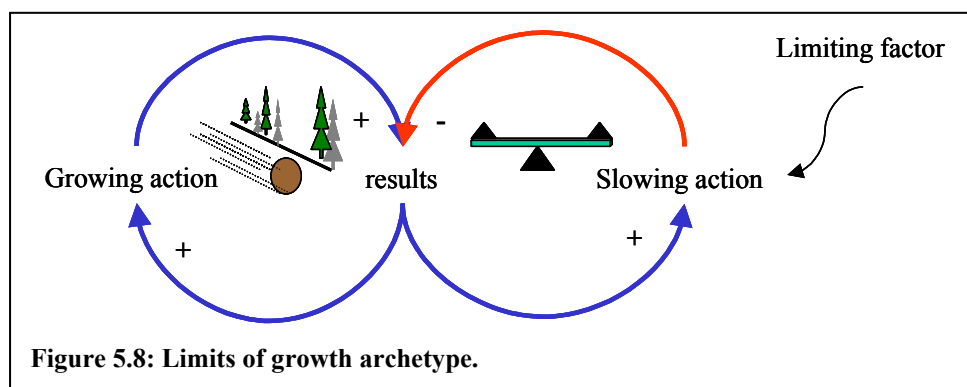
In order to overcome the complicated nature of causal loops, a classification system was developed which made it possible for an organisation to locate its unique situation within a particular category and to identify and implement some solutions that are appropriate to it. These categories, called archetypes, are really diagrams that show typical combinations of feedback and balancing loops that often occur in organisations. Some examples of archetypes are "Fixes That Fail" (in which "solutions" seem to backfire) to "Tragedy of the Commons" (in which organisations "overgraze" a limited resource, such as administrative support). Archetype descriptions explain common patterns of behaviour that organisations can compare to their own circumstances. Once it is clear that a particular archetype fits the actual situation of the company, there are certain strategies that may be used to give the company greater leverage in dealing with their problems. The archetypes provide a basic format with some definite prescriptions, so that interrelationships may be easily seen. Likewise, the various archetypes are related to one another and the identification of one archetype may reveal the need to consider others (Senge *et al.* 1994).

The next section presents the "limits to growth" archetype, which is discussed because cultural archetypes developed in chapter nine exhibit similar behaviour.

#### **5.6.5.2 Limits to Growth Archetype.**

A Limits' to Growth structure consists of a reinforcing loop, the growth of which, after some success, is offset by the action of a balancing loop. In this structure the "growing" action adds to the "results" (outcome). The "results" then add to the "growing" action (in our example going on a diet will produce weight loss. This will in turn reinforce the diet plan). This is the reinforcing loop and while this loop is operating the results interact with a limiting factor (feeling weak in our example) to add to the slowing action. The slowing action then subtracts from the results see Figure 5.8 (sacrificing the diet plan).

In situations where a "*Limits to Growth*" structure is evident the reinforcing loop generally operates for some time with little apparent limiting action from the balancing loop.



Once the results reach a certain level the slowing action begins to limit the growth that was being experienced. Since the focus had been on the reinforcing loop, which was probably producing something desirable, the slow down in results are usually confusing. The normal action is to place more emphasis on the growing action, which then tends to produce no additional growth, only more confusion. The Limits to Growth structure then reaches a point where the “growing” action actually inhibits growth.

### 5.7 Conclusion to the chapter.

This chapter presented an in depth literature survey that provided the framework for considering innovation as a dynamic process. The concept of dynamic capabilities, which expands on the research-based theory of the firm, was discussed first and the notion of the knowing organisation introduced next. Knowledge was depicted as a dynamic resource and various models of knowledge conversion, building, and linking were presented. Other literatures explored included those on organisational learning and the characteristics of the learning organisation and these concepts were seen as inseparable from knowledge management. Finally a systems approach and particularly the soft systems approach with its methodologies and tools were outlined. Of these, the concept of archetypes and in particular the “Limits to Growth” archetype was important and forms an important tool of analysis in Chapter Nine.

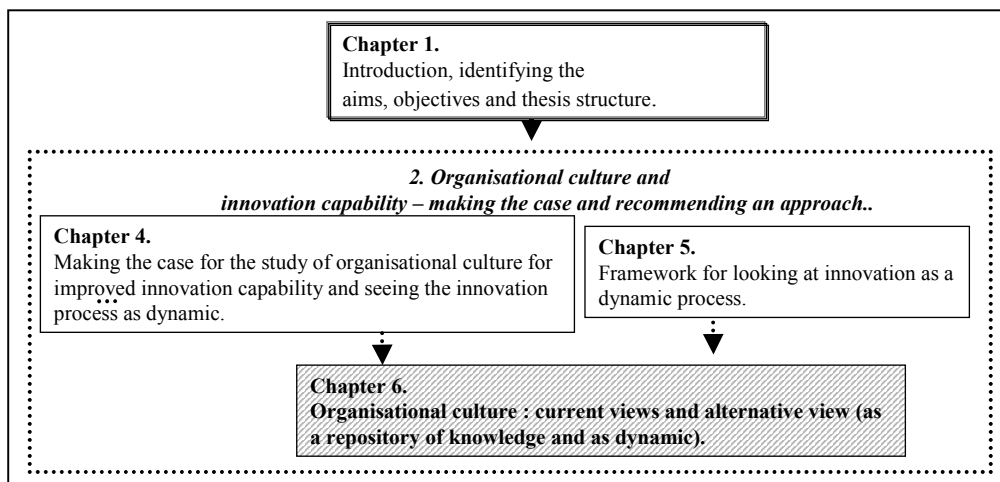
The next chapter explores the literatures on organisational culture and presents an overview of the thinking in this area. It then uses some of the literatures presented in this chapter and others to conceptualise organisational culture as a repository of knowledge. A cultural knowledge matrix is also developed that helps to locate this knowledge in Chapter Nine.



## Chapter 6: Exploring organisational culture.

### 6.1 Introduction and purpose of chapter.

Chapter Four made the case for considering the study of organisational culture as an important factor in understanding innovation capability and also saw the innovation process as dynamic. Chapter Five explored a number of literatures that provided the framework for looking at innovation as a dynamic process.



The purpose of this chapter is to explore the current thinking on organisational culture through a literature survey. A number of models of culture are also presented. It then uses some of the literatures from Chapter Four and additional literatures to conceptualise organisational culture as a repository of knowledge. This repository consists of eight layers; the environment, the organisational mission, vision and values, technology, knowledge structures, management style and organisational structure, the individual, the collective and the organisational memory. A cultural knowledge matrix is then presented that helps locate the knowledge within these layers.

### 6.2 Organisational culture.

John van Maanen (1988) defines organisational culture as

*“ the knowledge members of a given group are thought to more or less share; knowledge of the sort that is said to inform, embed, shape, and account for the routine and not so routine activities of the members of the culture.... A culture is expressed (or constituted) only through the actions and words of its members and must be interpreted by, not given to, a fieldworker... Culture is not itself visible, but is made visible only through representation”(pp.3).*

Cultures emerge as a result of repeated experiments and experiences around what appears to work well, in other words they are learned. Over time the pattern becomes more of an automated response to a particular situation, and the behaviour becomes what can be termed as “routine”. Organisational routines exist around how projects are managed or new products researched. These create and are reinforced by various kinds of artefacts, formal and informal structures, procedures and processes which describe “the way we do things around here” and symbols which represent and characterize the underlying routines.

Levitt and March (1988) describe routines as established sequences of actions for undertaking tasks enshrined in a mixture of technologies, formal procedures or strategies and informal conventions or habits. Importantly they are seen as evolving in the light of experience that works, they become the mechanisms that “transmit the lessons of history”. In this sense, routines have an existence independent of particular personnel, new members of the organisation learn them on arrival, and most routines survive the departure of individuals (Levitt and March, 1988). Equally they are constantly being adapted and interpreted such that formal policy may not always reflect the nature of the routine, as Augsdorfer (1996) points out in the case of 3M. The important thing is that routines are what make an organisation different even when they carry out the same basic activity. They are firm specific and must be learned.

These simple routines need to be integrated into broader capabilities which when taken together make up an organisation’s capability in managing innovation. As routines represent embedded behaviours which have become reinforced to the point of being almost second nature – “the way we do things around here”, they can also become a weakness by representing ingrained patterns of thinking of the world. While they are often indicators of resilience they can become barriers to thinking in different ways.

Innovation in organisations, especially in established organisations, entails by definition some measure of disturbance of the status quo. Innovation involves dealing with uncertainty whereas many key players in large organisations see their role as minimizing it. In consequence innovation involves a socio-political process (Kanter, 1982, 1983; Pettigrew, 1973). Internal acceptance of, let alone commitment or buy-in to, organisational innovation is not a one-off decision. On the contrary, it typically requires a whole series of repeated decisions (Cool, 1997). Even if innovation has been secured in

one part of the organisation, the intra-organisational diffusion may be highly problematic. Power and status systems reinforce these routines (Buchanan and Badman, 1999; Pettigrew, 1979).

As Schein (1996) has observed, organisations have cultures, which often fail to align, and this can be a source of failure of organisational learning and innovation. Learning, innovation and change are closely interrelated. Dickens (1992) and Latour (1993) among others question the separation of human culture from nature. All humans are actors but not all actors are human is a neat encapsulation of the argument that the physical and natural are part of culture. Organisational culture is not only manifest through the perceptions, beliefs, norms, actions, relationships and behaviours of humans but through the ‘hardware’ and structures that constitute its physical and institutional presence (Law, 1994). Culture shapes the character of an organisation and organisational culture therefore requires closer scrutiny. In empirical work a common approach has been to identify the artefacts of a culture, such as the unique symbols, heroes, rites and rituals, myths, ceremonies, and sagas of an organisation, and then to explore, to a greater or lesser extent, the deeper meanings of these artefacts (Deal and Kennedy, 1982; Hofstede, 1991; Martin, 1992; Trice and Beyer, 1984; Wuthnow and Witten, 1988). Culture can be perceived as the "social glue that " binds the organisation (Golden, 1992; Smircich 1983). It can also result in a meaningless and static ‘blanket’ identity and definition to be cast over the whole, or parts, of an organisation. To make it useful we must focus upon multiple cultures – meaning, norms and values – within and between organisations, their sub-groups and the environment in which they operate. This should include an ability to modify culture in response to its changing environment.

### **6.2.1 Subcultures.**

The term subculture refers to the concept of “routines”. Organisations develop particular ways of behaving as a result of repetition and reinforcement. These patterns reflect an underlying set of shared beliefs about the world and how to deal with them and form part of the organisation’s “culture”. Two contributors within organisational theory, John van Maanen and Stephen Barley (1985) define subculture as:

*“a subset of an organisation’s members who interact regularly with one another, identify themselves as a distinctive group within the organisation, share a set of problems commonly defined to be problems of all, and routinely take action on the basis of collective understanding unique to the group”(in Hatch, 1997, pp.226).*

Researchers have proposed two frameworks for describing the differences between subcultures. Siehl and Martin (1984) believe that subcultures are defined in relation to an organisation's overall cultural patterns, especially with respect to the cultures dominant values. In this view, subcultures are classified according to whether they support, deny, or simply exist alongside the dominant values of the overall culture. Countercultures defy the dominant values of the larger culture of which they are part. Orthogonal subcultures maintain their own independent values alongside the dominant values of the overall culture. Another group of researchers distinguish subcultures according to occupation, work group, hierarchal level, and previous organisational affiliations (Hatch, 1977).

### **6.2.2 Cultural models.**

There are many models of organisational culture that can be found in the literature (Trompenaars and Hampden-Turner; 1997, Hofstede, 1984; Cameron and Quinn, 1999).

Trompenaars and Hampden-Turner (1997) provide cross-cultural comparisons to how different societies manage time, personal space, communications and provide practical tips and guidelines for communicating and doing business in different cultures. Trompenaars and Hampden-Turner advocate that a useful way of thinking about culture comes from knowing the following.

*"Culture is the way in which a group of people solves problems and dilemmas" (pp6).*

All cultures distinguish themselves from others in the way it chooses solutions to certain problems which reveal themselves as dilemmas. Trompenaars and Hampden-Turner look at these problems under three headings: those which arise from our relationships with other people; those that come from the passage of time; and those which relate to the environment and examine culture within these three categories. Next from solutions that different cultures have chosen to these universal problems they identify seven fundamental dimensions of culture five of which come from the first category. These are:

1. Universalism vs. particularism: do people apply abstract social codes or rules uniformly to all situations, or change codes, rules, and behaviours to suit each unique context or set of relationships?
2. Individualism vs. communitarianism: do people in the community or society regard themselves primarily as individuals, or primarily as members of a group?

3. Neutral vs. emotional: should the nature of people's professional interactions be objective and detached, or is displaying emotion appropriate even in a professional context?
4. Specific vs. diffuse: are relationships in an organization or community limited to the contractual activities, or are even business and professional activities assumed to engage the whole person – their interests, hobbies, family, land, culture, etc.?
5. Achievement vs. ascription: achievement evaluates people based on what they have accomplished, on their activities; ascription evaluates people based on birth, kinship, gender, age, connections, educational institutions – qualities are ascribed to people and based on their connections.

The other two are attitudes to time (which is the societies look at time) and attitudes to the environment (some cultures see the major focus affecting their lives and the origins of vice and virtue as residing within the person while others see the world as more powerful than the individual and see nature to be something to be feared and emulated).

Hofstede (1984) explored the differences in thinking and social action that exist between members of 40 different nations. He argues that people carry “mental programs” which are developed in the family in early childhood and reinforced in schools and organisations. These “mental programs” also contain a component of national culture that are expressed in the different values that predominate among different cultures. Hofstede's work is specific about the number of elements of which culture is composed and identifies four main dimensions along which dominant value systems in the 40 countries can be ordered and affect human thinking. These dimensions are in brief are:

1. Power Distance Index (PDI) focuses on the degree of equality, or inequality, between people in the country's society.
2. Individualism (IDV) focuses on the degree the society reinforces individual or collective, achievement and interpersonal relationships.
3. Masculinity (MAS) focuses on the degree the society reinforces, or does not reinforce, the traditional masculine work role model of male achievement, control, and power.
4. Uncertainty Avoidance Index (UAI) focuses on the level of tolerance for uncertainty and ambiguity within the society - i.e. unstructured situations.

Hofstede (1984) added a fifth dimension - Confucian dynamism – which was subsequently described as a culture's long-term orientation which focuses on the degree the society embraces, or does not embrace, long-term devotion to traditional, forward thinking values.

Cameron and Quinn (1999) developed the Competing Values Framework initially from research conducted on the major indicators of effective organisations. Thirty-nine indicators from previous studies on organisational effectiveness were submitted to a statistical analysis and as a result two major dimensions and four main clusters emerged. One dimension differentiated effectiveness criteria that emphasised flexibility, discretion and dynamism from criteria that emphasise stability, order and control. The second dimension differentiated effectiveness criteria that emphasise an internal orientation, integration and unity from criteria that emphasise an external orientation, differentiations and rivalry. These two dimensions form four quadrants each representing a distinct set of organisational effectiveness indicators and represent four major cultural types. The names of these cultural types were chosen from literature that explained how over time different organisational values became associated with different forms of organisations and also matched key management theories about organisational success, approaches to organisational quality, leadership roles and management skills. These were briefly:

1. The hierarchy culture. This organisational culture is characterised by a formalised and structured place of work and procedures govern what people do. Maintaining a smooth-running organisation is important, formal rules and policies are in place and stability, predictability and efficiency of the organisation are the long-term concerns.
2. The market culture. The organisation with this type of culture is focused towards the external environment instead of internal affairs and focuses on transaction with external constituencies including suppliers, customers, contractors regulators and so on. This culture operates through economic market mechanisms, mainly monetary exchange and as a result the core values that dominate this culture are competitiveness and productivity and therefore a clear purpose and an aggressive strategy.
3. The clan culture. This culture has a similarity to family-type organisations. Shared values and goals, cohesion, participativeness, individuality and a sense of we-ness

are dominant. It displays typical characteristics of teamwork, employee involvement programs and corporate commitment to employees.

4. The adhocracy culture. This culture developed as the world moved from the Industrial Age to the Information Age. An organisation with this culture can configure itself rapidly when new circumstances demand and adaptability, flexibility and creativity are fostered where uncertainty, ambiguity and information-overload are typical. This type of culture has to produce innovative products and services and to adapt to new opportunities.

These models presented are all high-level classifications and some are at trans-national level. This thesis looks at intra company classifications especially in terms of innovation capability. The knowledge economy recognises the need to understand organisational culture as an important factors affecting innovation capability and this case has been made in Chapter Four. There has been little work in this area and this thesis addresses that gap.

The next section presents an alternative conceptualisation of organisational culture that forms the basis of understanding the relationship between organisational culture and innovation capability in this thesis.

### **6.3 A conceptual model of organisational culture as a repository of knowledge.**

This section presents a literature review on organisational culture that leads to the development of a conceptual model of organisational culture as a repository of knowledge and the development of a cultural knowledge matrix.

Much has been written about innovation and creativity from idea generation to down streaming, operationalisation and commercialisation. Within this, culture has been recognized as a primary determinant and its understanding and nurturing has become an essential organisational responsibility. Innovation requires an organisational culture that constantly encourages and focuses the organisation's members to strive for innovation, and provide an environment that is conducive to creativity. This has been put aptly by Buckler (1997), who defines innovation as the entire spectrum of activities necessary to provide new value to customers and a satisfactory return to the company or entrepreneur. He further describes innovation as more holistic in nature, and as "an environment, a culture – almost a spiritual force-that exists in a company" and drives value creation.

### **6.3.1 Culture as a system of knowledge types and processes.**

Innovation is increasingly perceived as a generic need in all industries, and can be seen as knowledge dependent (Prusak, 1997). Innovations are a result of a group's knowledge of new markets and or new technical possibilities. Efficient operations come from shared knowledge about how things work and about how they could work. This is what inspired Hewlett-Packard's Lew Platt to say: "If only HP knew what HP knows, we could be three times more productive!" This is especially true in a globalized world of constantly changing and challenging competitive markets. To remain competitive, organisations must therefore, efficiently and effectively create, capture, harvest, share, and apply their knowledge and expertise. They must also have the dynamic capability not only to bring that knowledge to bear rapidly on problems and opportunities as they emerge but also to continually replenish it.

Rapid changes mean quicker knowledge obsolescence. This entails a constant internal change, including new strategies, structures, processes and tools and most importantly a need for people and organisations to learn rapidly (Prusak, 1997). Close attention has to be paid to the people, culture, organisational structure, and information technology as knowledge is rooted in human experience and social context (Havens and Knapp, 1999). Earl (1994) suggests that knowledge management requires a combination of technological and social action, while Davenport *et al.* (1998) stress the need to successfully navigate the political, organisational, and technical challenges, as well as appreciating the depth of the cultural change required. Organisations must develop ways of ensuring that the culture is conducive to knowledge sharing (Wharton, 1998). Wah (1999) puts forward the idea that the key issue is to 'instil a corporate-wide culture that encourages knowledge sharing', while Martiny (1998) stresses the human side of managing knowledge as the hardest part. All this points in the direction of the softer aspects of organisational culture, people and knowledge sharing.

In general organisations exist independently of particular individuals, but it should be recognized that individuals acquire information in problem solving and decision making activities. This focus on individual cognitive activities as the central element in the organisation's acquisition of information reflects an active construction of organisational culture. The information retrieval is through either individual recollections or through shared interpretations. However, interpretations of problems and solutions vary with



individuals. In other words behaviour is tied to the world as it is perceived (Green and Lemon, 1996). The latter point is important in a cultural sense because the ‘world view’ that underpins organisational behaviour may not coincide with that of the individuals or groups carrying out that behaviour. The thread of coherence that characterizes organisational interpretations is made possible only by the sharing of interpretations. Thus through the process of sharing the organisational interpretation system in part transcends the individual level. This is why an organisation may preserve knowledge of the past even when key members leave (Weick and Gilfillian, 1971).

In its most basic sense therefore, organisational culture refers to the present information processing activities and the past stored information of an organisation that can be brought to bear on present decisions. Information for decision-making is stored in various physical locations (Simon, 1976), accepted procedures (Cyert and March, 1963), and even standards of dress and protocol, and furniture arrangement (Smith and Steadman, 1981). Culture develops as learned behaviours get embedded in the organisation and the implementation of future decisions is dependent on the information retrieval from the various artefacts.

The lack of clarity and appreciation of organisational culture in terms of its knowledge processing and sharing capabilities puts additional pressures on the study of innovation and organisational learning. The value of the specialized knowledge that exists as embrained, embodied, encultured, embedded and encoded knowledge in organisational processes and routines has to be recognized. Embodied and embedded knowledge refer to knowledge located in bodies and routines while embrained, encultured and encoded knowledge refer to knowledge that is located in brains, dialogue and symbols (Blackler, 1995). A clearer understanding of these forms of specialized knowledge must be accompanied by an understanding of their attributes in terms of whether the knowledge contained is explicit, tacit or cultural. Literature on this has been explored in Chapter Five and has implications for understanding the relationship between culture and the implementation of new behaviours and practices, particularly in relation to the flow of information and storage.

#### **6.4 Towards a conceptual model of organisational culture.**

This section looks at the existing organisational literature and conceptualises organisational culture as a repository of knowledge. The repository consists of eight

layers and these are; the environment, the organisational mission, vision and values, technology, knowledge structures, management style and organisational structure, the individual, the collective and the organisational memory.

#### **6.4.1 The layers of the knowledge repository of organisational culture.**

##### ***The environment***

In systems terms the environment is that which resides outside of a system of interest (Fortune and Peters, 1990) and perhaps more relevant to this thesis, that which can influence but is not influenced directly by that system. In other words much of the uncertainty that an organisation encounters is grounded in its environment. Global economics, lifestyle changes, the educational competence of potential employees will all affect how an organisation operates but as a rule that organisation will only have a limited influence on the processes themselves. It is, however, a key feature of a learning culture to scan that environment, formally and or informally, to access information and insight about it and to introduce adaptive capability into the organisation to respond to it. The term redundancy is often perceived as pejorative, as are slack and fat, whereas they can also indicate the ability to respond to the unforeseen in ways that are not covered by existing procedures and mind-sets however effective they are in meeting clearly defined objectives with limited short-term uncertainty attached to them.

##### ***Mission, vision and values.***

An organisation's values can be communicated partly through the abstract 'cultural stamp' of a mission statement. These are often dismissed as meaningless or disreputable (Eden and Ackerman, 1998) because they appear ambiguous and fail to translate into a framework for action. A greater degree of freedom in the setting and implementation of strategy exists at higher levels in an organisation but some of the principles for which a strategic response is set are equally apposite at the level of individual and collective operations. The subsequent interpretation of these principles impacts upon future decision making at all levels and is reflected in the individual and collective schema of the organisational members.

##### ***Knowledge structures.***

An organisation, at its root, is a cognitive enterprise that learns and develops knowledge (Argyris and Schon, 1978). There is a common shared perspective of environmental events and organisational abilities, which is believed to have an impact on the strategic

behaviour and performance of the firm. This shared perspective is described as a general knowledge structure that can store a dominant general management logic (Prahalad and Bettis, 1986). The basis for knowledge structures are experiences obtained through contact with the environment. As the organisation gains more experience and learns from it, it becomes more of an expert in its field and the knowledge structure becomes more complex.

The organisational knowledge structures which consist of a core and peripheral set, are different from the normally accepted definition of organisational culture in two ways (Lyles and Schwenk, 1992). Whereas culture and climate refer more to affective or emotional elements, the concept of knowledge structures deals with a narrower focus of goals, cause-and-effect beliefs and other cognitive elements. Knowledge structures are also more closely linked to an organisation's strategy for survival and more subject to change than an organisation's climate or culture, neither of which changes readily or provides specific strategies for action. The core set contains knowledge about the firm's basic purposes and goals, while the peripheral set contains knowledge about sub goals and about the behaviour or steps necessary to achieve them. A tight coupling of the sets indicates a consensus between organisational members about the basic mission of the firm, how to achieve it and to interpret environmental signals. These firms seek to maintain the status quo and avoid change. They are highly rigid and do not have the flexibility to respond to change. Firms with a loosely coupled structure by contrast tend to incorporate more disagreement and alternative interpretations about how to carry out the firm's mission and be more flexible in intervention (action taking) strategies.

### ***Technology.***

There has been, and to some extent remains, a tendency to see technology as the process whereby knowledge is created and shared. However, this view is becoming increasingly discredited as cultures of learning and innovation recognize that the appropriate role for technology is as a set of tools for storing data, facilitating data management and communicating explicit knowledge. It is only through using these tools in appropriate contexts that knowledge (tacit and explicit) can be generated.

### ***The management style, organisational structure.***

Nelson and Winter's (1982) evolutionary theory of the firm assumes that organisations provide a special context in which the explicit and tacit modes of knowledge are selected

through the interaction with external economic reality and its reflection in organisational routines. Teece (1996, 1998a) identifies flexible boundaries, high-powered incentives, non-bureaucratic decision-making, shallow hierarchies and an innovative and entrepreneurial culture as required attributes for highly flexible and responsive knowledge intensive organisation.

An organisation's ability to innovate and learn will be affected by the different management styles that are adopted. Incremental and methodical approaches will inform about changes to the current way of working (single loop learning) whereas 'fliers' and risk takers or those capable and willing to operate outside of accepted norms will potentially provide insights that are qualitatively different from it (double-loop learning).

### ***Individuals.***

In the past there has been extensive research on cognitive structures and processes that impact organisational behaviour, Ford and Hegarty (1984) on cognitive maps, Argyris and Schon (1978), Levitt and March (1988), Hedberg (1981) on organisational learning, Daft and Weick (1984) on interpretative systems, Mason and Mitroff (1981) on assumptions, Dunbar *et al.* (1982) and Hambrick (1981) on frames of reference. Individuals have their own recollections of what has transpired in and about organisations. This information can be retained in their own memory stores (Cowan, 1988), in their own belief structures (Walsh, 1988: Walsh *at al.* 1988), assumptions (Brief and Downey, 1983), cause maps (Weick, 1979), values (Beyer, 1981) and articulated beliefs (Sproutt, 1981). Individuals in an organisation retain information based on their own direct experiences and observations (Argyris and Schon, 1978; Nystrom and Starbuck 1984).

### ***The collective.***

The complicated nature of most projects requires the pulling together of a range of skills. Even when individual expertise necessitates working in isolation or through small groups, that expertise has to 'fit' the project and the other members of the project have to see how different contributions fit together. In consequence, team working is fundamental and the skills balance of a project / group team are important in determining innovative capacity. This balance within teams, or the emphasis given to different skills, should vary according to the technological or social emphasis of the work.

While the disciplinary balance of the team does not, of itself, indicate innovative capability the ability to appreciate how different competences complement each other may well do so. This suggests a number of factors for consideration. For example is there a need for ‘mavericks’ who can think ‘outside of the box’ and if so when should this be utilized? Similarly, the ability to link skills sets in such a way that something new emerges is itself a skill and is key to the creative capability of a team. Such integrative skills need to be both recognised within the organisation, its teams and individuals and underpinned by experience of other disciplines and industrial contexts. The willingness to share expertise combined with a preparedness and ability to ask and receive (trust issues) is an important feature of innovative capacity as is the communication necessary to identify, locate and learn from that expertise.

***Organisational memory.***

Earlier theorists have postulated that organisational memory is embodied in standard operating procedures (March and Simon, 1958). They believed that “past events, promises, goals, assumptions, behaviours” are stored in memory, whereas Argyris and Schon (1978) asserted that “learning agents, discoveries, inventions, and evaluations must be embedded in organisational memory”. Hall (1984) described an organisation’s memory as comprised of cause maps, architecture, strategic orientations and standard operating procedures. It has also been viewed in terms of structural artefacts that over time lose their effectiveness and become obstacles to change (Starbuck and Hedberg, 1977), while others have attempted to list its contents (Argyris and Schon, 1978; Daft and Weick, 1984; March and Olsen, 1976). Argyris and Schon (1978) have also argued that organisational memory is only a metaphor and so by extension “organisations do not literally remember”. Alternatively, Sandelands and Stablin (1987:136) have raised the possibility that “organisations are mental entities capable of thought” and Walsh and Ungson (1991) define organisational memory in its most basic sense “as stored information from an organisations’ history that can be brought to bear on present decisions”.

Based on this literature, organisational culture can be conceptualized as a multi layered knowledge repository that has behavioural qualities and the ability to process and store information. The conceptualisation offers an alternative approach to cultural analysis and by viewing organisational culture as an “entity” that can be described by its *structure*, it

poses interesting questions on the *form*, *type* and *nature* of the knowledge that it contains. These form the knowledge dynamics of organisational culture.

### 6.5 The cultural knowledge matrix.

The following section deals with these aspects and relates them to the preceding section on organisational culture as a repository of knowledge. This results in what is referred to as the cultural knowledge matrix of an organisation (Table 6.1). The different types and forms of knowledge interact dynamically to form an organic system of knowledge both at the level of the system and at the level of the individuals it embraces. Spender (1996) argues that these different levels interact organically constituting and reconstituting each in an effort to harness the creative properties of their participating members and develop system level capabilities.

	Embrained Formal, abstract or theoretical knowledge “universal laws” Individual explicit	Embodied Action oriented -Context specific  Individual tacit	Encoded Signs and signals Information  Collective explicit	Embedded Knowledge in systemic routines  Collective tacit	Encultured Shared understanding  Collective explicit
Environment				X <i>Tacit</i>	
Mission, vision &Values			X <i>Explicit.</i>	X <i>Tacit</i>	
Technology			X <i>Explicit.</i>	X <i>Tacit</i>	
Knowledge structures	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
Management style org. structure.	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit.</i>	X <i>Tacit</i>	X <i>Tacit</i>
The Individual	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit.</i>	X <i>Tacit.</i>	
The collective	X <i>Explicit</i>	X <i>Tacit.</i>		X <i>Tacit.</i>	X <i>Tacit</i>
Organizational memory			X <i>Explicit.</i>	X <i>Tacit.</i>	

**Table 6.1: The cultural knowledge matrix.**

The X's in the boxes in table 6.1 indicate the location of each knowledge form. For example embrained knowledge is located in the following layers: the knowledge structures, management style and organisational structure, the individual and the collective. The reason for this is that embrained knowledge is formal, abstract or theoretical knowledge that is “individual and explicit”. Similarly embodied knowledge is action oriented knowledge, context specific and is “individual and tacit”, encoded

knowledge is located in signs and symbols that is “collective and explicit”, embedded knowledge is located in systemic routines and is “collective and tacit” while encultured knowledge is shared understanding located in dialogue and is “collective and explicit”. These aspects of knowledge have already been discussed in more detail in section 5.3.3.2 and the cultural knowledge matrix is used in Chapter Nine to help locate this knowledge.

## **6.6 Conclusions to the chapter.**

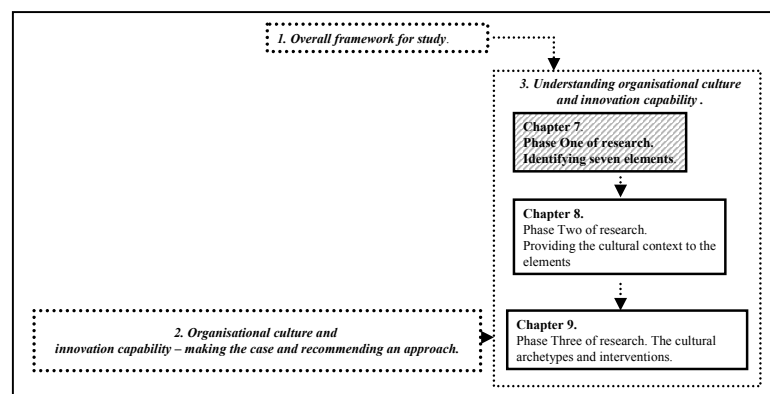
The chapter presented the current approaches and related literatures to the understanding of organisational culture. A number of models of culture were also presented. An alternative view conceptualised organisational culture as a repository of knowledge with eight distinctive layers. A cultural knowledge matrix was then developed that located the different knowledge forms in these layers. This matrix will be adapted for the final phase of the fieldwork intended to establish an improved understanding of organisational culture and innovation capability.

The next chapter presents the output of the first phase of the fieldwork.

## Chapter 7: Phase One - exploring the innovation context.

### 7.1 Introduction and purpose of chapter.

Much energy is spent on developing technological inventions, yet we are only beginning to understand, and to enumerate, the complexities involved in successfully “shepherding” an invention before it can “make it” as an innovation in the marketplace. Organisations and the groups and individuals that constitute them have multiple, often conflicting perspectives and goals, each with their own internal logic that affects how ideas are exploited. Understanding this can be the first step in (re)examining the more routine practices in organisations.



This chapter is the first of three chapters that come under the general heading “understanding organisational culture and innovation capability” as presented in the thesis structure and ties in with the aim and objectives set out in section 1.4.3. It addresses the first objective of this study, that of identifying the key elements within organisational culture that affect innovation capability. It begins by identifying the barriers, drivers and down streaming routes for new ideas and considers the measurement criteria for “innovation”.

The research activities of this phase include data collected through semi-structured interviews within the research domains described in Chapter Two. Analysis of the data results in the identification of seven key elements that affect innovation capability. These elements were selected in line with Carney’s (1990) “ladder of analytical abstraction” that was presented in section 3.5.1. The process began with a text, trying out coding categories on it, and then moving to the identification of themes and trends, and the



testing of hunches and findings. This was an attempt to delineate the “deep structure” within the data and then integrating it into an explanatory framework. The seven elements identified through this process were: reward systems, leadership, communications, organisational structure, empowerment, risk taking and management perceptions and sense making of the environment. The chapter concludes with an exploration of literatures on these seven elements.

## 7.2 Identifying the key elements within organisational culture that affect innovation capability.

The first phase of the research was carried out with the managers of the six domains introduced in Chapter Two and reflected on the conceptual framework. These are summarised in Table 7.1.

Domain name	Characteristics of domain as depicted on matrix (figure 2.2).
A. Management	Situated in the middle of the four quadrants, A, B, C and D, the management reflects both the old and new style of management. This position is indicative of the fact that the management is concerned with both its present and future technological trajectories and competencies including the corresponding strategies relating to these.
B. Business Modelling Team (Strategic tools)	Situated between the top half of quadrants C and D, the unit is focused on exploring and providing new techniques (strategic tools) on current issues. It provides solutions within BT.
C. Advanced Multimedia Group (New Services)	Being the only domain situated between quadrants A and B, this is an old unit that was considered to be working in the “old” ways combining various technologies and producing demonstrators. Its efforts to understand the context of application explains its movement towards quadrant B. It also considers itself as “maverick” in its approach to innovation.
D. Brightstar (Exploitation)	Set up as an incubation unit to realise full value of ideas generated on site, this domain is in quadrant C. It focuses on realising value from its activities by providing down streaming routes including creating JV's, spin-offs, licensing etc. The position reflects its focus on present technological trajectories and competencies and present short term strategies of realising present revenues.
E. Business, technology futures, BT Internet and multimedia applications (New services)	This unit is situated mainly in quadrant C but some of its activities can be placed in quadrant D. This is a reflection of the units focus on both the present short term strategies in response to its present technological trajectories and competencies, but the migration of its position toward quadrant D reflects its evolution in developing its technological trajectories and competencies to meet future challenges with corresponding strategies associated with that.
F. Next Generation Internet Research (new services).	Situated firmly in quadrant D, this position reflects the domain's research focus on future technologies and products. It is a highly focused unit concentrating on a given number of technologies and developing expertise.

**Table 7.1: Domain summary as reflected on the conceptual framework in Chapter Two.**

The activities in phase one of the research were subdivided into the following tasks.

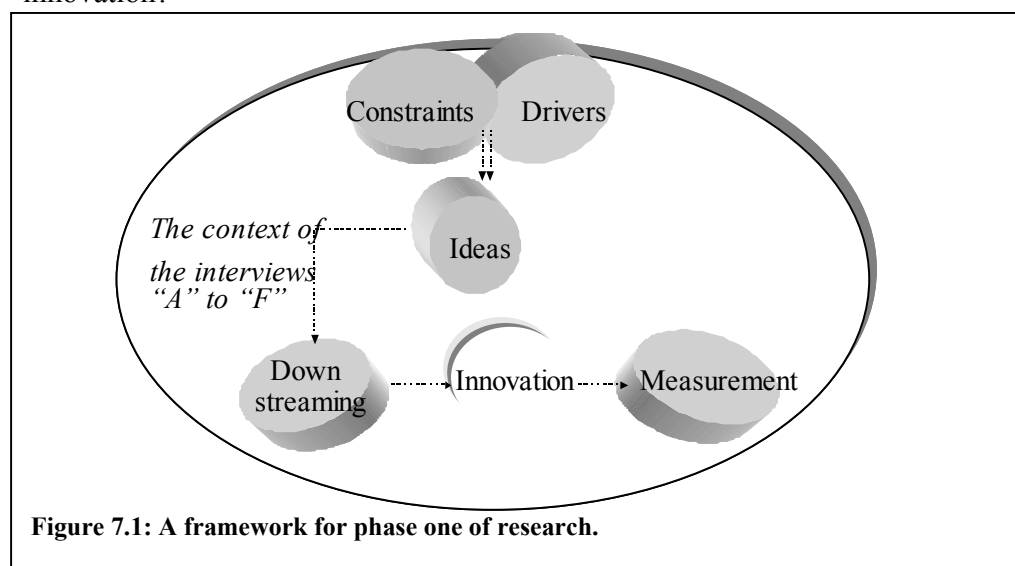
1. To undertake exploratory interviews with twenty four senior managers of the six research domains to: (a) validate the conceptual framework presented in Chapter Two (Figure 2.2), (b) establish an understanding of the context of the research

- environment and (c) identify the key elements that affect innovation capability within the organisation and to synthesise these with the conceptual framework presented in Chapter Two to develop an initial conceptual model of organisational culture.
2. To present these findings to a group of senior managers including the domain managers with responsibility for running the research programme. This would be undertaken through an interactive workshop where the model would be discussed in detail and new ideas taken on board. This workshop would also provide the focus for the next phase of the research.

The outcome of the activities described in point two are presented in Chapter Eight.

The framework presented in Figure 7.1 was used for Phase One of research and the questions that it set out to investigate were:

1. What were the drivers and barriers to innovation?
2. How were ideas down streamed leading to innovation?
3. How was innovation measured i.e. what was considered to be a “successful” innovation?



Over a seven-day period the exploratory fourteen face-to-face semi-structured interviews were conducted at BT's Adastral Park. All interviews took place in the informal atmosphere of the interviewees' offices and discussions sometimes carried on in the cafeteria over lunch. Although the interviews were originally scheduled for one hour, all of them overran by 30 to 45 minutes and follow up discussions where necessary took

place by e-mail to clear any ambiguity. The interviews were recorded on audiotape and detailed notes taken.

### **7.3 Analysis of exploratory interviews.**

The next section describes the analysis of the data collected from these interviews and is presented under the general headings of “drivers”, “barriers”, and “measurement”. Downstreaming is discussed under drivers and barriers and refers to the method, or process that provides a route or channel for further exploration and/or exploitation of an idea(s). Drivers, barriers and measurement are defined in the respective sections.

These general headings are then examined under the subheadings of reward systems, leadership, communications, organisational structure, empowerment, risk taking and management perceptions and sense making of the environment. These are the seven elements that were perceived to affect innovation capability and were derived from the identification of common themes from within the collected data (see Section 7.1, Carney, 1990). It should be noted that these subheadings are not mutually exclusive, for instance a flatter organisational structure may also result in improved communications. These are generic findings from the domains and where differences exist they are highlighted and reasons for the differences examined. These generic findings are supported by relevant quotes that reflect similar views expressed in other domains. For example a quote supporting a “driver” under the element “communications” and attributed to a particular domain reflects a view similar to the other domains unless otherwise stated. Measurement is presented under the subheadings of “perceptions”, “position of, and comparison to markets”, “capital expenditure and value creation” and “others” and can all be attributed to the cultural element “leadership” as these measurements were based entirely on the views on achievement of the leadership of the six domains. Some of the other categorisations considered but not used were teamwork, creativity, political agendas, bureaucracy and entrepreneurship as they were not consistent themes across each of the six domains. Their implications to innovation capability are however reflected in the seven elements chosen for example bureaucracy is reflected in the elements leadership and organisational structure.

Detailed individual domain analysis is presented in the Appendix 1, Tables 1-5.

### **7.3.1 Drivers.**

Drivers are defined as processes or factors that aid, encourage or enhance the innovation process.

#### **7.3.1.1 Reward systems.**

Rewards systems were introduced to drive innovation but their effectiveness as a driver of innovation was questionable. This element was considered more as a barrier and is discussed as such.

*“The people who won some of these awards succeeded despite the organisation rather because of it which suggests that personal drive and risk taking were drivers in some employees” Manager Domain A.*

#### **7.3.1.2 Leadership.**

Leadership was perceived to be an important cultural driver for innovation. This was evident in all the domains and especially true for Domain D where the manager described the environment as “full of enthusiasm and passion”. Traditionally BT had an environment where the value of innovation was not recognised but the experience now was that if the leadership could show a person that:

*“not only was it all right to innovate but also a requirement, then everyone could enjoy and innovate willingly”. Manager Domain E*

Employees through good leadership were being encouraged to be innovative and various initiatives such as the “new ideas scheme”, seminars and workshops had been put in place to achieve this. Speakers from industry were also being invited into the organisation to give talks on how innovation capability could be improved (through lateral thinking for example).

*“We are encouraged to be innovative, but there is no corporate policy on innovation as such”. Manager Domain E.*

Leadership that provided a clear research focus and direction was perceived to be a driver. Domain “F” for instance had been directed to work on ten technologies and this was seen as a positive development by the researchers who could now explore ideas without fear of being penalised for “looking” in the wrong direction. This was also seen to increase “serendipity”.

Top-notch world-class scientists who were leaders in their field were working for BT and this in itself was a tremendous driver that attracted skilled staff. These experts were also constantly reinforcing their reputations for example by publishing papers.

Leadership was also perceived to be responsible for bridging the gap between technology and business. This was a move away from a technology push to that of understanding the business context and the nature of the market and this was seen as an important driver. Domain C had worked on pioneering technologies such as fibre optics and was considered to be an “ivory tower”. It had recently made a concerted and conscious effort to break out of its “technological isolation” by understanding the business context.

*“This place was seen to be an ivory tower where we all enjoyed ourselves creating wonderful new concepts. But we were disconnected from the real world. I think we have been forced to address that because of our concerns about the inability to get value out of the work we believe is sometimes there”*  
Manager Domain C.

Understanding the short-term needs of the organisation were also important drivers and an example of this was Domain E that focused on services that provided a platform for e-business and Internet auctions. This was attributed to leadership.

*“So we needed to understand some of the business context, some of the drivers and move away from the sort of technology push to a more demand in the market. We needed to become more responsive to the company’s short-term needs and try to maintain a balance there”.* Manager Domain E.

MBA’s were being recruited in an effort to understand the business context and training was being provided to the other staff on the basic principles of business management. Experienced business-oriented managers were also taking up the role of guardians and advisors to these domains. This was an effort by leadership to bridge the gap between the technologists and the business.

*“We have supported that attribute very significantly with people in our unit and have a lot of people who act as a part time business sector manager. So they are gaining experience in working in the market teams but their day job is still the technology, the work we do here”.* Manager Domain C.

Another example of leadership as an important driver of innovation was found in Domain D which recognised that most of the people coming forward with new ideas were technologists in one form or another and that their business and marketing acumen was relatively small. A business mentor (who worked on a part time basis as well as in their own time) was appointed to work with the idea originator on the technology, and to “look and feel” the market. This should commitment and if the idea got through, they began to engage third parties within and outside BT. These were people who were market focused and market led and had been identified as being the best in that area and brought in to help move an idea to the presentation of a business proposal within four weeks. The proposal was then taken to an incubation board that analysed it for its financial merits,

funding requirements and market potential. If successful a budget, typically a quarter of a million pounds and a time scale of six months, was then allocated. In this time the team engaged the market, talked to customers, suppliers, and potential partners. The project was then spun out through the Joint Venture partners while Domain D managed the transition.

*“So really we are telling the people that you can come here with a bloody good idea and within four months to a year we can create a whole business for you. And we will provide you with the business skills, the marketing strategy, the finance necessary, the commercial, the legal, everything that you need, so all you’ve got to have is an idea or a passion” Manager Domain D.*

Leadership that had an in-depth knowledge of the organisation, brought in skills from outside including people who could think differently, break rules and question existing assumptions were perceived to be drivers for improved innovation capability for Domain D.

*“The skill I bring is my knowledge and the context outside and if we mesh the two, it is the knowledge of who to go to. To break processes and to break the rules is an important part to make this happen. It is time and time again about people skills. You ask me and that would be my answer to BT’s problems. It’s all about bold leadership”. Manager Domain D.*

This radical thinking was attributed to its leadership and the perception was that resources were easier to obtain and processes were in place to say to the applicants with good ideas that:

*“yes, we like that, therefore we are adding this resource to make the next thing happen”. Manager Domain D.*

Compared to the other domains where the integration of skills, budgets and other resources were deficient and therefore perceived to be barriers to innovation, this was a fundamental new mindset. Extra resources such as entrepreneurial training, access to venture capitalists, other entrepreneurs, staff from business management schools, and consultants deployed by Domain D were considered as drivers to innovation and attributed to leadership and good management.

*“Yesterday, I actually sat in an incubator company, and the message from the incubator was that we are not sure about your financial model package but you’ve got a great management team. They are almost prepared to invest despite the doubts because of the quality of the management team”. Manager Domain D.*

Domains E and F which focused on both current and future development of technologies (exploration work) drove innovation through good leadership by establishing an

understanding of business needs and then looking at ways of meeting them. Managers who actively forged closer links with the people involved in the development of business strategy, and also engaged in activities that built good relationships with the rest of the organisation were perceived to improve innovation capability.

Both formal and informal drivers to the down streaming of ideas were evident. Informal drivers required networking which was dependent on leadership whose personal contacts rather than established formal routes played an important role.

*“Some of the formal routes were activities such as the “investing in our future, and for a better life”, “BT ideas”, and the “new ideas” schemes. These activities were themselves formal but the aim was to encourage informal activities “. Manager Domain B.*

This is also reflected in the following statement.

*“People like myself who are managing the programme are walking around the company making contact with the business units, product lines, and understanding what their issues are and what they are trying to achieve and then putting them in contact with people in the labs or other parts of the business”. Manager Domain A.*

Engaging in internal and external publicity, making formal proposals to the corporate funding body and keeping in contact with regular customers were other down streaming routes attributed to leadership. Domain C also made and presented demonstrators and used licensing agreements as down streaming routes while Domain D engaged in Joint Ventures including the setting up of start up and spin-off companies.

*“I think it is true to say that we have become more imaginative and have a broader range of downstream routes for innovative ideas. In the past the only way to explore would have been to take an idea down the product line. Now we are saying that is one route, but we can also spin off a company”. Manager Domain E.*

Out of concern for finding down streaming routes, managers were forging closer links with the business units.

*“One of the reasons that we have migrated towards the business and the market arena is that we are concerned with down streaming routes”. Manager Domain C.*

Getting customers involved from idea inception to concept development and testing was a proven down streaming route for Domain C and this was perceived to be a leadership attribute. Other domains tried to identify a potentially interested customer very early and making sure it was aware of its work.

### 7.3.1.3 Communications.

The willingness to improve communication within the organisation as well as with other organisations was perceived to be one of the main drivers of innovation by all the domains. BT relied on a number of suppliers to develop its products and its ability to communicate and bring this expertise to bear on its research activities was a driver to innovation. All the domains shared the view that innovation, especially in competitive markets, required quick information feed-in and this depended on the development of efficient and quick communications achieved through the establishment of informal networks that cut through formal outdated channels.

*“I would be very wary of having a formal process because by definition a formal process is going to be one step behind reality, reality is changing very rapidly. Once you have got a formal process in place you are six to twelve months behind reality”. Manager Domain A.*

Establishing effective communications was an important requirement in the conception of Domain D whose entrepreneurial approach to innovation was radically different from the rest of BT. Senior management for this unit were hired from industry who implemented a variety of radically different work practices that included the use of personal initiatives, contacts, networking and interpersonal skills for faster and effective communication. Informal drop in sessions where employees could explore their ideas with those in charge of research budgets was an effective communication channel that provided an excellent down streaming route for potential innovators in this domain.

*“People just come in, they have pizza, bacon patties, sit around here and say “I have got an idea, a bold new idea that I think can be good, make it into a business”. Manager Domain D*

Increased communication and interaction between the various business and research units within BT due to disappearing traditional product boundary lines resulted in innovation being located in the day-to-day activities and was perceived as bridging the gap between the technologists and the business.

*“The era of working in isolation and sitting in “ivory towers” is neither feasible nor desirable.” Manager Domain C.*

Improved communications with the customers (end users) proved to be a powerful driver for innovation. This involved the participation of customers in product and service testing, improving customer feedback and involving the customer in the development of new products and services (for example the New Digital Home project, Remote Medical Diagnosis).



Communicating and working with start up companies and venture capitalists was actively pursued by Domain D as down streaming routes while Domain C did a range of things that included presenting its activities at major BT events, exhibitions, and publishing. It also established closer links with the front end of the business though improved communications with the right people. Domain E communicated and promoted its interests through weekly highlighted reports that went out to the rest of the business and also held presentations and briefings of general managers on a regularly basis. This also enhanced its reputation which was considered an excellent down streaming strategy.

*“Thankfully in this area we have got sufficient reputation from the work we have done. We have promoted it strongly through the business so that as soon as they started to think about the work, it did not take long to say that there was somebody doing that”. Manager Domain E.*

#### **7.3.1.4 Organisational structure.**

Restructuring of the organisation into a flatter and flexible organisational structure had resulted in effective communication, greater responsibility and freedom in decision-making and cooperation between domains. This had brought multiple benefits that included a better understanding of the different work practices, exchange and sharing of information and access to expertise which resulted in shorter development times.

*“If you look around the company, it does not have a uniform culture and it does not have a uniform way of working. If it did, it would be a “straight jacket”. You have to have diversity across the company and such a lot of innovative practices are going on which are different from one part of the company to another, even if they are tackling a similar problem. Recent reorganisation has resulted in a flatter structure and as a result in a better “fit” with the overall culture and the way a particular part of the company is working”. Manager Domain C.*

Greater responsibility and decision-making powers also meant greater risk taking and autonomy in deciding how research was carried out. This was an important development as research activities could be now be carried out in direct response to changing environmental conditions using innovative responses without fear of reprisals from senior management. It also meant that interesting ideas could be followed without the approval of senior management.

*“I think you will see from recent announcements that BT is reorganizing itself into different business groups. One of the ambitions has got to be to give various units greater autonomy in terms of taking decisions, following through decisions and to an extent seeing competition. I think it’s only that competitive sort of environment that generates innovation”. Manager Domain B.*

An exceptional feature of Domain D was the constant shifting of roles and responsibilities of its senior staff, which led to learning and flexibility. As a result management was perceived to be “grounded” and aware of a wide range of activities in the organisation which meant that there was less danger of getting isolated and ignored. Senior management was perceived to be more accessible which resulted in improved innovation activity and the dissemination of valuable information throughout the organisation. The group was constantly changing its work practices in order to maximize innovation and opportunity its teams were matrixed so that no one in particular was in charge and that resulted in shared responsibility and accountability.

#### **7.3.1.5 Empowerment.**

Informal communities played an important role in generating and driving new ideas and managers regarded this non-hierarchical approach as being unofficially empowered to use their own networks to drive innovation.

*“What I think is quite typical of BT is that informal communities generate patterns of new ideas, new knowledge and new patterns of thinking. From evidence we get from our awards this does reinforce the view that this informal empowerment of managers is important for exploring new ideas”. Manager Domain B.*

Greater autonomy as a result of reorganisation of the organisational structure meant managers were responsible and accountable for their actions and this manifested in greater risk taking and less fear of reprisals. Internal politics also played a considerable part in empowering the research domains. Domain D was for example was empowered by senior members of the board to by-pass any formal structures that were considered as hindering innovation – it had support from the “top”.

*“Don’t get bogged down by processes and manuals, go do it your way. If you want a champion for this give us a call and we will clear all the obstacles out of the way right to the top”. Manager of Domain D describing a conversation with a board member.*

This had implications on resource allocation, and combined with this direct route for down streaming, the innovation environment was described as “dynamic and exciting”.

An effective way of down streaming ideas was through experienced managers who had the empowerment to make decisions that cut through a lot of processes.

*“Some of the more powerful ideas are at the local level and not the product level. In my previous role I actually ran a large development unit and I would say the majority of the good ideas were implemented within that unit because there were ways of cutting out unnecessary tasks, or doing tasks quicker or*

*consolidating facilities between projects so that we could do things with less people quicker, get a product out quicker, those sort of things". Manager Domain A.*

Product champions provided invaluable routes for down streaming often because they had the ability to avoid barriers. They also had the ability to establish links between the various parts of the organisation and going around bogging processes.

*"You need somebody who can sort of say, "that is interesting". You need somebody down in the core of the business to influence the people who make the decisions regarding corporate funding. You are standing in the middle saying you have got this wonderful idea, you might not be able to convince the corporate funding people, so what you are looking for are product champions. Someone else who will lend their weight and is willing to take risks, that is the real issue". Manager Domain C.*

### **7.3.1.6 Risk taking.**

The lack of risk taking was largely considered to be a barrier to innovation but Domain D was an exception. It prided itself in challenging the existing culture and saw the organisation as full of people, for whom the most important thing was to avoid failure and not create success. It was encouraging risk taking and advocated learning from failure and this was a message that was being communicated with clarity and action.

*"We have to get out of the way or do things that make them uncomfortable - they are trying to avoid failure then to make success." Manager Domain D.*

Domain F with its focus on particular areas of research also considered itself as a risk taking domain empowered by the top echelon.

### **7.3.1.7 Management perceptions and sense making of the environment.**

Share value and not profit was a perceived driver for innovation. BT was traditionally seen as a blue chip company and the share value related to current earnings. Over the last few years the perception of BT by shareholders was not that of a traditional telephone company, but of a new Internet and multimedia communications company which meant that its share values were predicted on future rather than current ones. This message was a prime driver at the board level and had filtered through to the various layers of the organisation.

*"The idea that research should focus on future rather than current earnings has permeated down through BT and that is why I think there is this journey of less control, encouraging innovation and spreading the management more thinly so it can move quickly because there is more understanding at the board level. The profits might dip in the short term, but the shareholders are looking at the future and you are potentially increasing the value of the company because what you are selling to the shareholders are capabilities rather than its current delivery. I think this has been the main driving force at the senior level". Manager Domain A.*

This had huge implications both in the way that research was conducted and also the areas that it was conducted in. BT for example had missed the first wave of the Internet because the perception was that it was not viable business and this had translated into a lack of support and vision. But that perception had changed:

*“They have changed that now. There is still resistance but the board has taken steps and set up divisions to develop the Internet business” Manager Domain F.*

This change in perception meant a bolder approach to the exploration of new ideas and increased serendipity of research, the outcome which was less frustration and a willingness to share ideas.

All the domain managers were in agreement that the management’s perception and sense making of the environment was influenced by the organisation’s mission and vision statements which had not changed for a long time and needed to be rewritten to reflect its current activities. Recent reorganisation into different specialised business had however resulted in them writing their own mission and vision statements.

### **7.3.2 Barriers.**

Barriers are defined as factors that inhibit, restrain or constrain the process of innovation.

#### **7.3.2.1 Reward systems.**

An inadequate reward system and constant change in “direction” was perceived to lead to high turnover of staff and one of the adverse effects of this was the loss of tacit knowledge especially of hardware oriented skills. There was nothing in the system that encouraged people to be passionate entrepreneurs and combinations of these factors were perceived to be barriers to innovation.

*“In fact to the contrary, the system and the way it is managed including the risk reward profiles are stacked against success. The bonus scheme was so pathetic, it was hardly worth working for”. Manager Domain D.*

Risk taking and rewards can be linked directly and the normal formulae is that the greater the risk taking the greater the rewards. The company culture was perceived to be risk averse and good at avoiding failure and with an inadequate and inefficient reward system in place the barriers to innovation were considered to be high.

#### **7.3.2.2 Leadership.**

Rigid processes that had been put in place for down streaming innovation were seen as contradicting the very notion of innovation and this was perceived to be a leadership issue and as barriers to innovation.

*“It’s always a contradiction between on one hand talking about innovation and on the other hand talking about a rigid process. I mean if you have got innovative people who are doing things in new ways, one of the things that they will be doing in new ways is the process itself” Manager Domain E.*

Weak leadership that failed to achieve a balance between on the one hand “almost maverick, or loose cannons” whose over enthusiasm about innovation resulted in people spending their whole time coming up with ideas and those that tried to focus upon issues that mattered was perceived as a barrier to innovation.

*“If you have a majority or a significant minority who are doing all that all the time, the company actually collapses into this introspective of “oh my gosh there are so many options which way do I go?” Manager Domain A.*

Good leadership was expected to provide a clear focus and a set of objectives that the rest of the workforce could follow. This was an issue of concern for Domain C because it was struggling to find its mark and focus due to a lack of direction from top leadership. This was in direct contrast to Domains D and F (which have been labelled as new services) where a set of clear objectives and areas of research had been prescribed.

A lack of appropriate funding was also perceived to be a barrier to innovation in all the domains except Domain D that had “buy in right at the top”. Getting funding for these domains was dependent upon leadership qualities such as personal contacts and initiatives and was described quite clearly by one manager as follows:

*“With the corporate office you make a formal proposal, with other areas you have to make personal contact with people who might have some money. We then come up with a proposal and the money it will cost. They in turn go away and see if they have the budget and that can be anywhere in the company” Manager Domain B.*

“Skunk works” were seen as an essential unofficial activity especially where numerous controls on innovative practices were in place. This is clearly illustrated by the following example.

*“A lot of the ideas we have worked on are what we call “skunk” projects. This means that they were projects which were not part of a written down project, proposal. There had quite a bit of flexibility. There used to be an amount of money around and one could bend its use for whatever you would like to do to an extent. A lot of bright ideas and concepts came from us doing things that nobody had told us there was any case for. There is no money to take a particular idea further, so you’ve hit a brick wall. And then you’ve got to think how am I going to get money into it, you’ve got to think how to get money to go forward and that depends on leadership” Manager Domain C.*

But obtaining funding especially for “skunk” projects was difficult and perceived to be a leadership issue.

*“It is not worth making a suggestion when you know damn well that you are not going to get funding for it” Manager Domain E.*

The requirement to write a business case for any project or idea was perceived to be a serious barrier for all the domains and was perceived to be a leadership issue as is evident from the following statement.

*“I am not knocking leadership here but very widely within the company there is a view that the business case process is very slow, very unresponsive, very risk averse and does not actually help” Manager Domain E.*

Another example of this and attributed to leadership was expressed by an experienced manager.

*“The inability to follow up most ideas is the requirement to produce a business case and BT is driven by business cases. The Internet never had a business case. We might have had a business case when it was first set up and it wasn’t actually to take up the world, which is actually what it has done. I think that the business case is one of the biggest problems, because the business case actually creates a false view. In order to get a business case adapted, you have to over hype the potential value of it over the short term and when you get out there and launch the product and it does not achieve its goals, then everybody says that the business case said it would succeed, it hadn’t therefore drop it” Manager Domain A.*

Writing up a business case especially for a disruptive innovation with the potential to dramatically change things was especially problematic. The organisation in the past had enjoyed a monopoly position in the telecommunications industry and was intent on concentrating on that success story which meant that any idea that could deviate it from that course was looked upon with suspicion.

*“Is there a market for that innovation? It was not the standard BT market you went to and so you had to persuade the lab, or product and services division, to take up this innovation and on the basis of that it was very difficult to write a business case”. Manager Domain E.*

It was also perceived that the leaders who had been given the responsibility of analysing and evaluating these business cases didn’t have the necessary insights to make a fair judgement and this seriously affected the ability of the managers to maintain a high level of morale and enthusiasm in their staff. There was a certain amount of disenchantment created within the ideas people that resulted in people either leaving or not expressing their ideas. This was in direct contrast to Domain D where people were encouraged to express their ideas freely and necessary discussion and resources made readily available.

The business planning cycle that was typically an annual cycle tied innovation to speed and this resulted in inflexibility and put extra burden and pressure on the research

domains. This barrier was perceived to be a barrier and attributed to “short sighted” leadership.

*“Sometimes to be truly innovative you have to slow things down, quieten things down” Manager Domain B.*

The decision making process was also perceived to be too structured and very few people could say,

*“this is what we will do - that was a big problem”. Manager Domain C.*

A lack of direction from the leadership and resistance by the management to change was perceived to be a barrier particularly in exploring new areas of research.

*“Now in a lot of research that was done originally, the company knew already what it wanted. This is what the company wants, go and make. It is and was more difficult in Internet products, which for a long time was resisted by people who could not see that BT had anything to do with the Internet business” Manager Domain F.*

This manifested in frustration because it was perceived that there was a lack of coherent strategy and vision for the type of business that the organisation wanted to be in.

*“It hasn’t had a coherent strategy for the business it wants to be in. Its strategy for expansion has not worked, but those are not problems to do with innovation, and innovation processes, more strategic issues like leadership. You could say that although frustrating, the system, as a whole is not too bad” Manager Domain F.*

There was also a perceived lack of a clear strategy on how to acquire new technologies in a much more entrepreneurial environment and how to exploit these outside of BT’s mainstream. Ego and personal politics of the leadership were seen as major obstacles in much of the organisation.

*“Its all command and control. It’s not about the job, so that evolves into a very political debate with a sort of a very political flavour around the organisation” Manager Domain E.*

Even when the strategic vision was clear at the top management level, a “mass” of middle management did not convey it to the rest of the organisation. This was perceived to be a significant barrier and the frustration it was causing was evident.

*“People at the top are really good. They want to go the new way probably but there is the barrier of the old school of management, the middle layers of management. I will put it like that and it is very difficult. We all get frustrated and just lie to protect them” Manager Domain B.*

Inadequate staff also caused frustration and the loss of staff through downsizing had led to a skills shortage and the feeling was that the organisation was not good at managing people.

*“It is quite difficult when you are trying to do a job. I have got ten people doing twelve peoples job. It doesn't work like that. Moreover the recent downsizing reflects that the company was not managing those three thousand people terribly well” Manager Domain B.*

Another source of frustration was the perception that the process side of innovation was problematic and often not thought out properly.

*“Certainly a lot of the systems are defined, built with one particular user group in mind and their convenience and other groups find it does not work very well for them” Manager Domain B.*

Frustrations also occurred because budgets determined things more than they should. The financial control processes were unnecessarily complicated.

*“It was a system designed to satisfy the needs of a limited number of very large customers, so that innovative ideas were ignored or side stepped”. Manager Domain C.*

Another source of frustration was the difficulty in following something up just because it was interesting. Serendipity was an issue of considerable concern.

*“You have to go to lengths to explain in principle why in the future it might be beneficial and this really affects the ability to follow up ideas that might be potentially useful”. Manager Domain B.*

### **7.3.2.3 Communications.**

The lack of appropriate communication channels that could connect different parts of the organisation with similar interests was perceived to be a major barrier. The Intranet as a communication tool was difficult to navigate and managers depended on their own informal networks and networking skills to obtain relevant information. This is exemplified by the following example.

*“We were dealing with something in mobile communications and this other unit had been looking for people in the company who were doing it. They did not know that we even existed and couldn't find our website either. This depends very much on people knowing you, and that is a networking issue” Manager Domain B.*

As a result important opportunities for making connections that could lead to major breakthroughs were being missed.

*“I would have to say that it is largely dependent on people matching up. Clearly there is a good chance that you can miss those sorts of things, if I am honest. I am sure there are examples of bodies of people doing work in a big company like ours who are not aware of other people having the expertise” Manager Domain E.*

Communicating ideas between the different teams and the front end of the business was difficult and this resulted in the loss of good ideas that could have made a lot of money for the organisation.



*“People at the front end of the business who didn’t understand how some the ideas could make money did not drive them forward” Manager Domain C.*

The mere size of the organisation reinforced some of these barriers to effective communications.

*“It is the communication channels in the sense that BT is such a large organisation, finding out who owns a particular activity and who has the ability to make strategic decisions and move things forward is tricky” Manager Domain C.*

A lack of a co-ordinated communication strategy when change took place in the organisation resulted in a lack of motivation and a feeling of isolation and was perceived to be a barrier to innovation.

#### **7.3.2.4 Organisational structure.**

The organisation was perceived to be hierarchical and those in authority considered not having the knowledge to make decisions. Whereas matrix management was a driver for Domain D, it was perceived to be a barrier by domains A, B, C and E.

*“Things like that can inhibit interaction because you tend to want to control from the line management perspective the resources you are using in the technical arena” Manager Domain C.*

Bureaucratic structures, which translated into numerous management layers each with their own agendas, were barriers that especially affected radical innovation (for example the development of an inkless pen as an interface to the PC).

*“Bureaucratic structures hinder innovation especially radical innovation because you are accountable to layers of management who often don’t understand the technology. Clearly if you go off and do something too radical in BT, it could be a disaster, and could actually have a negative impact on the business” Manager Domain E.*

#### **7.3.2.5 Empowerment.**

Apart from Domains D and E the lack of empowerment to make decisions without lengthy consultations was considered as a major barrier to innovation and perceived as linked to the risk adverse culture of the organisation and its bureaucratic structure. Experienced managers relied upon their own reputations to make decisions that would normally be made through time consuming formal channels. These reputations were seen as providing the “might” for being unofficially empowered.

#### **7.3.2.6 Risk taking.**

The dominant view was that the organisation was good at working within an existing paradigm, an existing set of products or a predictable technology. This position weakened when there was a shift in the existing paradigm.

*"I think we still have a very robust business investment appraisal and we try to work cross functionally across the company but all that falls apart when there is a shift in paradigm. It is a popular mythology in the company - the word on the street is that we missed the first wave of the Internet". Manager Domain A.*

This was attributed to the lack of risk taking by "the centre of gravity" (senior people) of the company who were not comfortable with the unknown and made huge generalisations. One senior manager expressed the view that:

*"because we have been very successful in the past, that tends to breed arrogance ...and changing all that with all the myriad of connections, physical and metaphorical is a very complex task". Manager Domain A.*

This had an adverse effect on innovation and this explained why there weren't many innovative proposals especially when considering disruptive technologies. This was attributed not only to risk taking but also to the "processes" in place.

*"They have to take a real risk on you and the BT processes don't allow that to happen". Manager Domain C.*

The organisation was not perceived to be good at taking risks and accepting mistakes. This culture of avoiding failure was considered to be a considerable barrier to innovation. The biggest "choke" was perceived to be the middle management. It was felt that taking risks and making mistakes were:

*"features that you had to have to succeed in the present commercial environment certainly in telecommunications. You have got to accept that mistakes will be made. At the back of my mind, there was this worry, there was this fear of making mistakes". Manager Domain C.*

### **7.3.2.7 Management perceptions and sense making of the environment.**

There was some confusion in the perception of some managers between invention and innovation. This was a barrier because the thinking in the organisation focused only on those areas that it was already involved in and the danger was that newer areas of exploration were ignored. This was compared to "resting on one's laurels".

*"Invention and innovation let me think about that. Invention seems to be a more basic function I might be wrong. I will look it up when you go. I have got a paper somewhere, innovation vs. invention and I don't know what it says" Manager Domain C.*

This lack of clarity was perceived to be a barrier especially when dealing with the front end of the business that thought of innovation in terms of a tangible product.

*"I know that parts of the business where innovation would be looked at with suspicion because they are charged with delivering a product, a bound product. Making sure it works and following procedures is very important because they want to make sure that the quality is right" Manager Domain E.*

Domain D was again the exception here as the whole perception of management was built on "entrepreneurship" and every improvement in process or the development of an

idea to the next small stage was considered as an innovation. The notion of learning from “our mistakes” was very prevalent.

A top-level manager felt that a barrier to innovation and creativity was the “thinking” within the organisation. This meant that people in authority especially those situated at the front end of the business and not directly involved with the research community had the perception that the researchers were an “odd bunch” and that most of their ideas were a waste of time and effort. This “prejudice” had a detrimental affect on creativity and was clearly a barrier to innovation.

*“The key idea is that people’s results and effectiveness depends on their thinking and the way they see the world. Innovation and creativity is seen as weird, wacky, strange stuff and as boffins at work at Adastral Park doing peculiar things, oh it will never happen and so on and so forth”. Manager Domain A.*

Another view on this notion of “the thinking” was the research community’s own mindset which was predominantly engineering.

*“I think in BT we tend to be binary, we tend to say either one thing or the other. It is a marketing company, it’s an engineering company, and it’s a financial company. I believe that all these things exist together and it is a paradox that we are neither one thing or the other” Manager Domain B.*

The view was also expressed that the “British” way of thinking was a barrier. What this meant was that the British were not good at selling their ideas with conviction and enthusiasm. An example given was that if an American had invented a gravity free machine s/he would “float in” and sell this idea whereas a British inventor would walk in with a flip chart and a bunch of equations!

*“The downside being that it gets by, it is very much improvisation but the upside was that it was quite free flowing and creative” Manager domain A.*

Due to rising competitive pressures the organisation was being forced to move to a new model and as a result the organisation felt amateurish instead of professional in the short term. This was a typical reaction of an organisation that had enjoyed a monopoly and was now faced with severe competition.

*“In the short term constant change causes pressures of coping with change. It makes it more difficult to entertain new patterns of thinking, new ideas and new approaches. When short-term pressures are on, the organisation reverts to established forms of thought and activity. In the long term it cannot go on doing things in the old fashion, and this becomes a powerful driver towards innovation and creativity” Manager Domain A.*

One of the main barriers in domain C was its concern about the front end of the business’s focus on short-term return. The business end’s perception was that making

money now was more important than what the technology could do in three or four years time.

*“They want to sell today’s products and services. We had quite a period when we were accused of having a negative effect, because we were publishing in the brochures various views of the future that the marketing and sales teams couldn’t deliver. We were talking 3,4,5 years after”. Manager Domain D.*

The slow speed at which the organisation reacted to challenges in its environment, especially in new areas that the organisation was venturing into was perceived to be a barrier and attributed to the management’s perceptions and sense making of the environment but could also be attributed to leadership and the organisational structure.

*“It is just the speed of things. Some of the innovations, say this research bit on site, we would probably take two years to get it out as a product. By the time you get it out, the time you have the product, you can go onto the Internet and buy it for fifty dollars from the States. That is dead now you know, so the whole attitude has got to change. You have to get things out really quickly”. Manager Domain E.*

While other domains struggled with getting enough resources to follow up ideas, the management’s perception in Domain D was that if a business was not going to be worth at least a hundred million pounds capital in the market in 2-3 years, it would not create it. The managers in this domain also felt that those in other research domains perceived it as “poaching” their best personnel for spin off companies. This perception was causing a lot of frustration amongst these managers with the result that Domain D was looked upon with suspicion and as an “outsider”.

*“Very few people at Brightstar are outsiders actually. They are frustrated insiders. In most of the groups you will find that there is frustration inside; I mean I am a representation of the frustration inside” Manager Domain B.*

As the organisation became more business focused, the managers felt that it was less innovative at the fundamental level whereas previously there had been in place a framework for research, especially in new technologies.

*“But I guess we are probably innovative in terms of new products and services but we are not so innovative in creating fundamental technologies. I don’t think we invent as much as we used to. I guess innovation and invention used to be much more closely related”. Manager Domain E.*

Again domain D was the exception considering itself as highly innovative as it continued to create short-term value.

### **7.3.3 Measurement.**

This refers to the method or process through which “value” is assigned to an innovative activity. The measurement of innovation was a very domain specific as there was no

specific “yard stick” that the organisation had in place. It was really up to the domain managers to find ways to satisfy the organisation of its research success and by implication its justification for survival. The common view was that the measurement of success of an innovation was a domain specific issue.

*“A better model for BT innovation is that each group, each team, each function, whatever delivers for itself, work out for themselves a model that works for them”. Manager Domain A.*

### **7.3.3.1 Perceptions.**

This refers to the unquantifiable attributes used to measure innovation activity. The following response typifies the general view on how success of an innovation was perceived.

*“If you had asked me that question two years ago, I would have said that a successful innovation is one that ends up as a product. If you can point to a product, a result of one or many innovations then they have been successful. I would be subtler now and say that a successful innovation is one that has changed the perception or thinking of the company. This is a lot harder to measure as it is subjective”. Manager Domain E.*

Managers had varying views on what constituted an innovation and the difference in what was considered as an invention or an innovation was a contributing factor on how innovation was measured. This was also considered under barriers and the implication was that quantification of progress was difficult.

*“It is difficult to quantify the extent of innovation that is going on and it is partly because of this business about the difference between innovation and invention”. Manager Domain C.*

One of the other unquantifiable measures used was whether the unit served a useful function and how much demand was there for it to continue doing that, not just from the corporate office but also from the rest of the business.

*“You could say how much demand is on us is a sort of measure of whether we are contributing anything of value” Manager Domain E.*

### **7.3.3.2 Position of, and comparison to markets.**

Comparisons with other European companies in terms of services and products supplied, was a yardstick often used to measure innovation. The European Quality Model was another way of measuring innovation, as were benchmarking and DTI surveys.

### **7.3.3.3 Capital expenditure on R&D and value creation.**

Measures at the executive level were the amount of money spent on R&D, investment in the group technology programme and shareholder value. Success was not measured in terms of a final product but according to the benefit a type of work had brought.

*“There is constant discussion in the corporate office. They do want benefits and they do try to identify the way that the money has been spent. What we did last year was to build a demonstration and then a simulation of a concept. This clearly was not a product but it saved £4 million. So they want to see benefits, in better decision making or saving money in some way” Manager Domain B.*

Domain D was the only domain that had just one measure of innovation and that was value creation.

*“One of the things about Brightstar was that for the first time there was direct coupling between innovation and value creation.” Manager Domain D.*

#### 7.3.3.4 Other measures.

Other measures included patents, time to market for new products, tangible products, and the number of publications.

#### 7.4 Towards an initial conceptual model of organisational culture.

This chapter has discussed the barriers and drivers of innovation in terms of seven elements that reside within organisational culture and have been identified as significant influences upon innovation capability. These are reward systems, leadership, communications, organisational structure, empowerment, risk taking and management perceptions and sense making of the environment and are now referred to as elements.

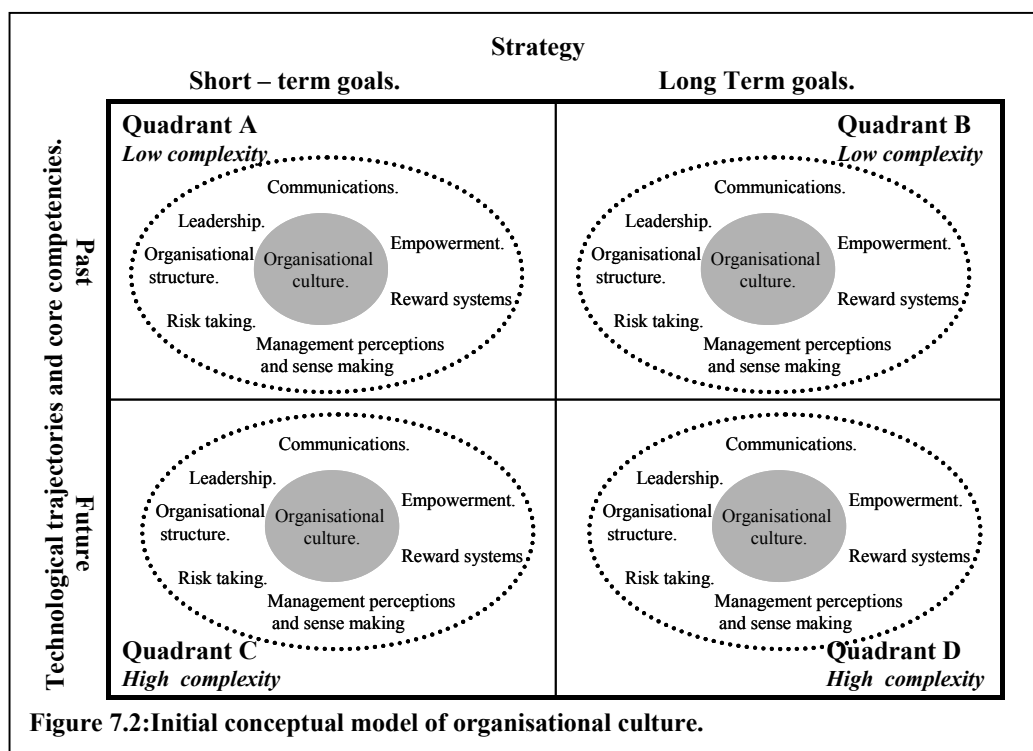


Figure 7.2: Initial conceptual model of organisational culture.

In the conceptual framework presented in Chapter Two it was evident that a key component that differentiated between contexts was not represented on the framework and the cultures that were evident within the organisation and helped to determine it as a whole had to be more clearly understood. The process of identifying the seven elements described above was the beginning of a process to do so. These elements were synthesised with the conceptual framework (Figure 2.2) to develop an initial conceptual model of organisational culture - see Figure 7.2. Each quadrant in this model reflects the seven elements. The initial conceptual model of organisational culture was presented to an interactive workshop at BT, where it was discussed and the agenda for Phase Two set. This workshop and Phase Two of research are described in Chapter Eight. The next section briefly explores the literatures on the seven elements.

## **7.5 Exploring the literature of the seven elements.**

Evidence from the previous section of this chapter identified seven elements, which affect innovation capability. This section explores the literatures relating to these.

### **7.5.1 Reward systems.**

Reward systems are a powerful motivator of behaviour and key to successful innovative capacity. Saleh and Wang (1993) found significant differences in the entrepreneurial aspects of reward systems used by highly innovative compared with low innovative firms. Angle (1989) found that individual reward systems increased idea generation and radical innovations while group reward systems tended to increase innovation implementation and incremental innovations.

### **7.5.2 Leadership.**

When discussing the critical factors of success, the importance of key individuals, such as product champions and technological gatekeepers and the top management commitment to and visible support for innovation are often emphasised (Rothwell, 1992). Senior management must be committed and willing to champion change initiatives in order to emphasize their importance and minimise employee resistance (Bashein *et al.* 1993). Leadership is a process whose purpose is to help direct and mobilize people and or their ideas (Kotter, 1990). Hammer *et al.* (1995) state “if your leadership is minimal rather than serious and isn’t prepared to make the required commitment then your Business Process Reengineering (BPR) effort is doomed to failure”. Leadership is viewed as the most critical single role that can stimulate innovation (Quinn *et al.* 1997).

### 7.5.3 Communications.

Effective communications within the company and its network of firms is necessary to achieve innovation and learning outcomes (Lawson and Samson 2001). It facilitates knowledge sharing by combining a wide variety of experiences, dialogue between workers, building on others ideas and exploring issues relevant to innovation. Innovative firms reward the cross-functional, cross-hierarchical, cross-cultural and cross-technological exchange of information and knowledge. Effective communication is also highlighted as an important tool in overcoming resistance to change. Davenport (1993) includes communication as one of the key enablers in process change, and Rothwell (1992) includes the “use of effective *Communication* to gain *Consensus* for *Change*” as part of his “10-C’s” within a people-centred framework for successful industrial innovation. The others are “*Champions* to sustain *Continuous Commitment* to *Change*, and a *Culture* that is *Customer Centred*”. Weisbord (1987) emphasizes the importance that “everybody has the chance to learn, grow and achieve” in order to develop a greater degree of self-control and innovation within the *organisation*. Organisational goals must be disseminated through the organisations layers so that it becomes a “living document that impacts on everything the company does” (Dooley, 1997). The pattern for success is increasingly favouring organisations that develop innovation processes that adequately manage the knowledge and technological skills that are both internal and in the environment.

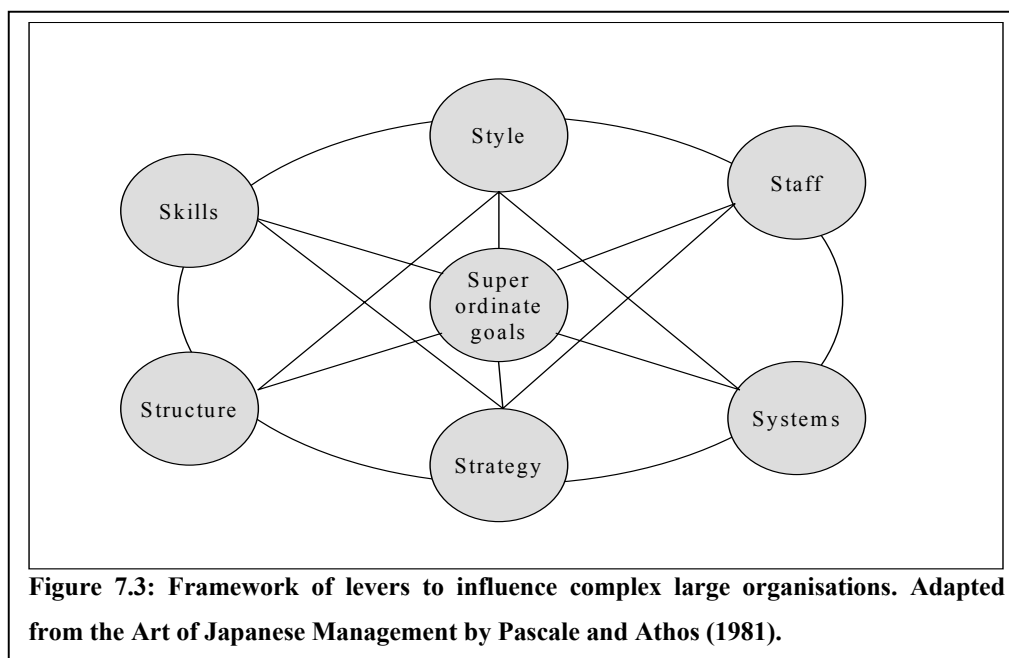
### 7.5.4 Organisational structure.

The form of organisational structure has a significant impact on an organisation’s ability to innovate internally. Much of the literature rehearses the familiar attack on the supposedly deadening effect of bureaucracy (Kanter, 1983; Peters, 1997). As businesses grow there is a tendency to add layers, becoming more mechanistic and institutionalised (Kanter, 1983). High performance firms motivate and enable innovative behaviour by creating permeable boundaries and breaking down barriers separating functions, product groups and businesses (Ashkenas, 1998; Maira and Thomas, 1998). The more permeable and organic the structures, the greater the potential for ideas. For example, 3M keeps divisions to less than \$200 million in sales, while Hewlett-Packard limits division size to 1000 employees. Burke (1987), following a synthesis of three leading authors in organisational development, states that the optimum structure for modern organisations is



“less hierarchical and more networked”. Champy *et al.* (1996) when discussing the advantages of “adaptive networks” state that labour is “not divided but rather shared among knowledge workers who may act as individual contributors or as part of a team”. A flat-networked structure that facilitates communication and encourages cross functional group operations represents the most advantageous style. Burns *et al.* (1961) promote an “open and horizontal style” to be adapted by organisations and West *et al.* (1990) supported the belief that a “democratic, collaborative style” is most suitable for encouraging innovation. While it is beneficial for the ultimate responsibility to rest with one individual since this avoids “buck-passing”, such an individualistic approach does not avail itself to teamwork advantages (Katzenbach *et al.* 1993). One of the core concepts of “systems innovation” is that innovation is systemic in nature with everyone in the organisation continually contributing to it (Dooley *et al.* 2000). While it is necessary for management to decide on the strategic path and to lead by example, they must also engage their employees in activities that positively contribute to the development of innovations.

Pascale and Athos (1981) highlight the importance of this when they include “staff” as one of the “seven-S’s” approach in their framework of the limited number of levers that executives have at their disposal to influence complex large organisations - see Figure 7.3.



**Figure 7.3: Framework of levers to influence complex large organisations. Adapted from the Art of Japanese Management by Pascale and Athos (1981).**

The others are super-ordinate goals, strategy, structure, systems, skills, and style. Davenport (1993) stresses that “if process innovation is to succeed, the human side of change cannot be left to manage itself”.

Some of these levers have a similarity to the elements of organisational culture that have been identified in this chapter to affect innovation capability, while others are similar to the criteria used in Section 2.2 to identify the six domains of research.

### **7.5.5 Empowerment.**

Engaging employees in the innovation process through empowerment and team working allows them to fulfil certain esteem and self-actualisation needs (Maslow, 1954). This draws on the expectancy theory (Vroom, 1964) for ensuring that satisfactory portions of the gains made by the organisation are passed on to employees. Empowerment is more than just delegating work to the subordinates; it also ensures that these individuals possess the autonomy and authority to make the necessary decisions to achieve their tasks. It requires a more democratic and collaborative management (West *et al.* 1990) that views its subordinates from a “theory Y” perspective rather than “theory X” perspective (McGregor, 1960). McGregor’s ideas were informed by Maslow’s “need satisfaction model of motivation”. Needs provide the driving force motivating behaviour and general orientation. Maslow’s ideas suggested that worker disaffection was due to poor job design, managerial behaviour, and too few opportunities, and not due to something intrinsic to workers.

#### **7.5.5.1 Theory X propositions.**

A manager holding to these would be inclined to believe that:

1. On average staff really do not want to work. If they had a choice they would not commit themselves to work, and avoid it wherever possible. They were self-interested and preferred leisure to working for someone else.
2. Work had to be structured and well specified and there was a need for more direction and control. In spite of good rewards, workers were still disinclined to consistently apply the effort expected of them. The manager in return resorted to more checks, instructions, exhortations and punishments. The belief was that most people wanted to be directed, and did not really wish to carry the burden of responsibility preferring instead to avoid it.
3. The workers had little ambition and preferred a secure and steady life.

Such a manager uses close supervision and defines jobs and systems that structure how workers allocate and apply their time. McGregor felt that such managerial views led to behaviours and organisational systems that relied on rewards, promises, incentives, close supervision, rules and regulations, even threats and sanctions to control workers.

#### **7.5.5.2 Theory Y propositions.**

A "Theory Y" manager believed that:

1. Given the right conditions employees applied their physical and mental effort to work as naturally as they did to rest or play. Work offered satisfaction and meaning.
2. There were alternatives to reliance on controls and there were other ways of linking individual effort with organisational objectives. If people feel committed, they would exercise self-direction and self-control in the service of the firm's objectives.
3. The workers commitment to the firm was a function of the "intrinsic" rewards associated with their achievement rather than to extrinsic rewards/punishments.
4. That if the right conditions were created the average person learnt to accept and seek responsibility. The Theory Y manager recognised the influence of learning.
5. The capacity to exercise imagination, ingenuity and creativity in the solution of organisational problems was widely distributed in the work force.
6. In modern organisations, the intellectual potential of the average person was only partially utilised and people were capable of handling more complex problems.

The Theory Y manager is more sensitive, and takes time out to explain, and comprehend the needs of the individual. He engages in joint-problem solving and interpersonal exchange with each member of staff. This requires trust building, consistency, and faith.

#### **7.5.6 Risk taking.**

Many studies have identified the willingness to take risks as a preferred behaviour for innovative firms (Saleh and Wang, 1993). Such firms do not however take unnecessary risks. They tolerate ambiguity but seek to reduce it to manageable levels through effective information management and tight control over project milestones. When mistakes do occur, innovative firms learn the lessons and do not hide from corporate view (Lawson and Samson, 2001). They have generally incorporated a systematic

process of reviewing failed projects as a valuable opportunity to learn and improve (Grady *et al.* 1993).

#### **7.5.7 Management perceptions and sense making of the environment.**

The crucial importance of management perception and sense-making of environment with regard to innovation has been noted by a number of researchers (Kim 1997; Lefebvre *et al.* 1994; Rickards, 1999; Sutcliffe and Huber, 1998; Weick, 1995). Copey *et al.* (1997, 1998) have made some progress in this direction when they discuss *the social construction of innovation in organisations* and the importance of understanding the innovation process from the point of view of individual actors.

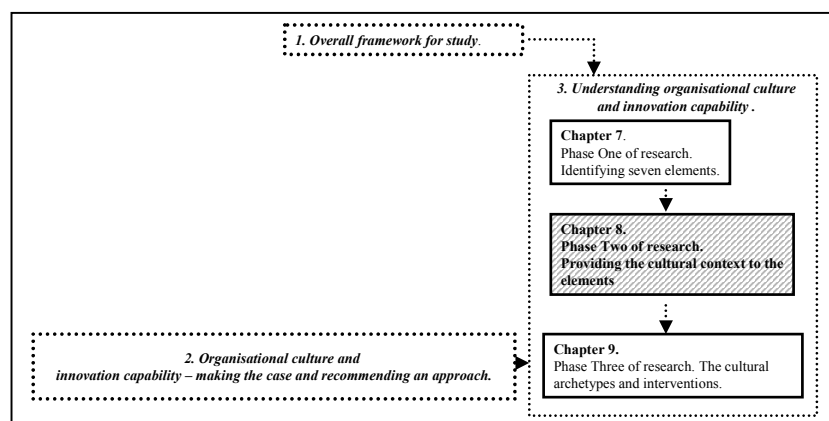
#### **7.6 Conclusions to the chapter.**

This chapter described Phase One of the research. This was the first chapter in Section Three of the thesis structure, “understanding organisational culture and innovation capability”, and it addressed the first objective set out in Section 1.4.3. Analysis of semi-structured interviews identified seven elements within organisational culture that affected innovation capability. These elements were synthesised with the conceptual framework presented in Chapter Two to produce an initial conceptual model of organisational culture (Figure 7.2). The latter part of the chapter explored the literatures relating to the seven elements.

The next chapter begins with a description of the interactive workshop held with BT’s research managers where the initial conceptual model of organisational culture was presented for discussion and Phase Two of research identified and implemented.

## Chapter 8: Phase Two—providing the cultural context to the elements.

### 8.1 Introduction and purpose of chapter.



Chapter Seven identified seven elements that affect innovation capability. The purpose of this chapter is to address the second objective of the study as outlined in under section 1.4.3 which is to provide a broader cultural context for these elements. From previous BT studies on organisational culture six distinctive configurations of cultural characteristics *cultural dimensions* are identified and then analysed in terms of the elements. This provides the cultural characterisation of innovation capability.

This chapter begins by describing the interactive workshop held with BT's research managers where the initial conceptual model of organisational culture (Figure 7.2) was presented for discussion and subsequent modification. It then describes the process of deriving the six cultural dimensions and concludes with the presentation of these findings to another workshop attended by BT managers.

#### 8.1.1 Interactive workshop - setting the agenda for Phase Two.

An interactive workshop with a group of senior managers including the domain managers with responsibility for running the research programme took place at BT's Adastral Park. One senior member of the Modelling team was connected to the conference through an audio link. The aim of this was to present the findings of Phase One of the research. A written report outlining the research process to date, and PowerPoint slides of the presentation, had already been e-mailed to all the participating members. This included the remote attendee who could view the presentation on his personal computer while at

the same time taking an active part in the discussion. An informal atmosphere, ideal for discussion and interaction, was created with plenty of food and drinks. The meeting lasted about two and half hours and was taped with additional hand written notes being taken.

The main agenda of the workshop was to:

1. Discuss Phase One of the research and get clarification where necessary.
2. Obtain additional output to the research report.
3. Set the theme and direction for the next phase of the research.

The discussions following the presentation resulted in the validation of the initial conceptual model of organisational culture (Figure 7.2) and with an outlining of the strategy for Phase Two of the research. This strategy would involve:

1. An examination of previous studies on organisational culture that BT had carried out. No attempt however, had been made to link these studies to innovation capability. The aim for this phase of research was therefore to link the relevant findings derived from these BT studies to the seven elements that were perceived to affect innovation capability previously identified in this research. Section 8.2 describes this process.
2. The outcome of this synthesis would then be presented for discussion to a second interactive workshop attended by a group of senior research and business managers. The outline strategy for Phase Three of the research would be formulated in this meeting. This is reported in Section 8.3

## **8.2 Integrating the elements with the previous studies of organisational culture carried out by BT.**

A range of studies on organisation culture previously carried out by BT (BT, 1999; BT, 2002; BT, 1997; BT, 1992, 1996, 1998; BT, 2000) were examined with the purpose of incorporating their findings into the initial conceptual model outlined in the previous chapter. The BT studies, the purposes of which are summarised in Appendix Two, had identified a range of cultural characteristics as the basis for individual and group behaviour and had also established the perception of these among the workforce. BT had used this data to develop guides (tool kits) that were made available to managers in areas such as action planning, team working and learning and development. What were perceived as the basics for good people management.

The internal BT studies and the cultural characteristics identified by them were not however integrated into a useful conceptual model for understanding the relationship between organisational culture and innovation capability. The aim of this phase of the research was therefore to undertake this synthesis and to extend it to include the seven elements identified as affecting innovation capability in Chapter Seven. The next section describes the cultural characteristics identified from the BT studies and their synthesis into six broad cultural dimensions.

### **8.2.1 The cultural dimensions.**

Each of the dimensions, and the related characteristics identified in the internal studies, are described below and the extremes (poles) for each dimension identified.

#### **Degrees of freedom** (Poles “relaxed” and “structured”).

Looked at rules and restrictions, responsibility and ownership of task, including risk taking / initiative.

1. Creativity and innovation present (relaxed) or absent / maybe even discouraged (structured).
2. Authority / autonomy and empowered management style (relaxed) verses excessive rules and bureaucracy which restrict (structured).

**Data sample:** *I have enough flexibility in my work to do what is necessary to give good service to customers (responsibility and ownership of task); I have trouble getting my work done because our priorities and objectives change so often; I have sufficient authority to do my job/work well; I am encouraged to be creative and innovative to meet my customer requirements; My manager encourages me to take considered business risks in order to meet customer requirements; I am satisfied with my involvement in decisions that affect my work.*

#### **Group interactions** (Poles “individual” and “group”).

Looked at peer level relations.

1. Social / physical contact with co-worker (Group) or isolated (individual).
2. Commitment and loyalty to co-workers (Group).
3. Team spirit present (Group) or absent (Individual).
4. Group flexibility (Group) e.g. welcomes new members (Group) or is it difficult to be accepted? (Individual).

**Data sample:** *Team meetings help us to operate more effectively; there is a good sense of teamwork in my team; the people I work with are willing to help each other, even if it means doing something outside their usual activities or job description; I think individuals who are different are readily accepted and respected.*

**Communications** (poles “open” and “closed”)

Looked at communications within and between work units.

1. Frequent feedback and recognition from management (open) or little/no feedback (closed).
2. Management communications skills are good e.g. provides a clear sense of direction (open), or poor communication skills (closed).
3. Human centred management and involving those concerned in decisions (open).
4. Co-operation/communication with other company units/teams common (open) or rare (closed).

**Data sample:** *My manager listens to my views; my manager focuses on the big issues; management provides a clear sense of direction; most of the time it is safe to speak up in the company; BT does an excellent job of keeping employees informed about matters affecting us; I am satisfied with my involvement in decisions that affect my work.*

**Balance** (poles “well being” and “challenging”).

Looks at the balance in people’s lives.

1. Are people able to achieve a balance between home and work (well being).
2. Satisfaction with workload and working environment (well being) or dissatisfaction (challenging).
3. Good job security and fair financial rewards (well being).
4. Trusting the company/management (well being) or little trust/confidence in management (challenging).

**Data sample:** *I am able to balance the demands of my work with my life outside the company; how satisfied are you with your workload; I am doing something I consider really worthwhile in my work; compared to others in the organisation my rewards are fair; in comparison with people in similar jobs in other companies; BT offers a level of job security as good as or better than the job security offered in most other companies in the telecommunications industry.*

**Working relations** (poles “rigid” and “easy” going”).



Looks at management and power relations.

1. Loyalty and commitment towards management from subordinates (easy going).
2. Fair treatment by management (easy going).
3. Includes trust issues such as fear of time off (rigid).
4. Hierarchy and strong command and control management (rigid) as opposed to empowering management style (easy going).

**Data sample:** *I am satisfied with my working environment; I get support from my manager when I need it; my manager can be relied on to do what he/she says will do; senior managers in BT genuinely care about our people; senior managers are doing all they need to do to encourage equal opportunities and diversity within the company; I believe company management: is interested in our well-being; I believe company management generally understands the problems we face in our work; in my judgement BT as a whole is well managed.*

**Time** (poles “long” term and “short” term).

Looks at the differing time scales.

1. Views within the company e.g. whether or not a company/ management has a long term/big issues view or a short term/cost cutting view.
2. Customer requirements important (long term).
3. Time pressures, e.g. flexible deadlines versus extreme time pressures due to changing priorities (short term).

**Data sample:** *I am committed to helping us achieve our vision of being the most successful worldwide communications group; I know clearly how my work contributes to the success of the company; in BT, we too often sacrifice the quality of our products or services in order to cut costs; we make very good use of people’s time and energies.*

The six distinctive configurations of cultural characteristics *cultural dimensions* were then analysed in terms of the elements derived from the earlier phases of research undertaken within the innovation and R&D environment (see Table 8.1).

The cultural dimension “degrees of freedom” is made up of a combination of the elements leadership, communications, organisational structure, empowerment, risk taking and management perception and sense making of the environment. Similarly the dimension “time” is made up of a combination of elements that includes leadership, communications, risk taking and management perception and sense making of the

environment. It should be noted that the term “communications” is used both as a dimension and an element. The communication dimension however is clearly a composite of the elements reward systems, leadership, organisational structure and empowerment and reflects the effectiveness of the communication. There is some similarity between these dimensions and the principles that underpin aspects of cultural theory (Douglas, 1994). For example the relationship between the amount of autonomy allowed to a worker and the extent to which collaboration takes place within teams. While these are predominantly social dimensions it must be remembered that they are in large part determined by the structural and environmental characteristics of the workplace.

Elements	Dimensions					
	Degrees of freedom	Group interaction	Communications	Balance	Working relations	Time
	Reward systems		x	x	x	
	Leadership	x	x	x	x	x
	Communications	x		x	x	x
	Organisational structure	x	x		x	
	Empowerment	x	x	x	x	
	Risk taking	x		x	x	x
	Management perception and sense making of environment	x		x	x	x

**Table 8.1: Six distinctive configurations of elements.**

### 8.3 Interactive workshop.

The outcome of this analysis phase was presented to a workshop attended by twelve research managers at Adastral Park. The meeting lasted two and a half hours, notes were taken and lunch was provided. The purpose of this workshop was to consider the six dimensions of organisational culture described above and to set the strategy for Phase Three of the research. The workshop felt that the cultural dimensions provided a useful framework for understanding how organisational culture might affect innovation capability and felt that this should be considered and modified by each of the research domains involved in the earlier phases of the study. Fourteen additional semi-structured interviews were organised and undertaken to meet this requirement.

#### **8.4 Conclusions to the chapter.**

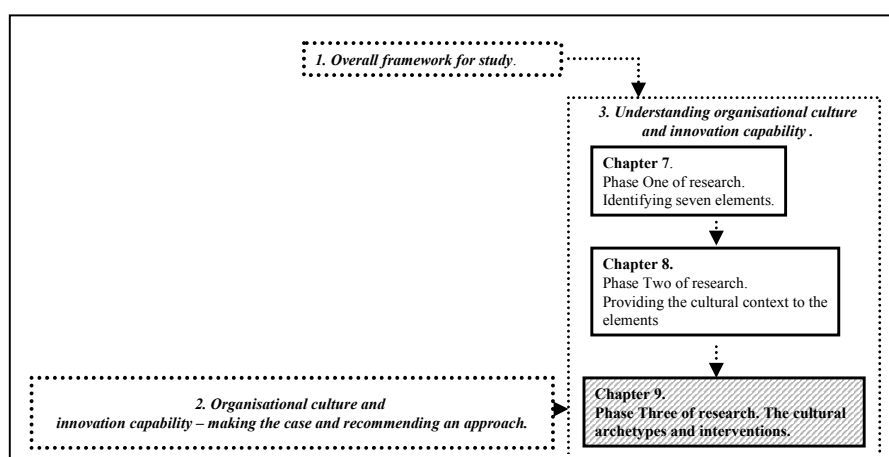
The chapter began by describing an interactive workshop with BT's managers where the initial conceptual model of organisational culture was presented with the seven elements relating to innovation capability. The outcome of this was the desire to incorporate previous studies on organisational culture carried out by BT with this study with the aim of providing a cultural context to the seven elements. Next from previous BT studies on organisational culture six distinctive configurations of cultural characteristics *cultural dimensions* were identified and then analysed in terms of the elements. This provided the cultural context for the seven elements.

This cultural characterisation of innovation capability was presented to a second workshop where the objective for Phase Three of the research was set. This would involve taking these cultural dimensions back to the domains in an attempt to derive the knowledge dynamics of organisational culture as it related to innovation capability. The next chapter describes this process leading to the identification of four cultural archetypes as they relate to innovation capability.

## Chapter 9: Phase Three - cultural archetypes and interventions.

### 9.1 Introduction.

This chapter describes Phase Three of the research and is also the final chapter under Section Three of the thesis structure “understanding organisational culture and innovation capability”. The purpose of the chapter is to address objectives 3 and 4 of this research as outlined in section 1.4.3 which are: (1) the identification of the different cultural classifications and an understanding of their knowledge dynamics and (2) the consideration of strategic interventions based on the knowledge dynamics of these archetypes that could lead to improved innovation capability.



The cultural variations are identified and developed as four cultural archetypes in this chapter. Both the literatures identified in Chapter Five and the conceptual model of organisational culture as a repository of knowledge presented in Chapter Six provide the necessary tools and background for understanding the knowledge dynamics of these cultural archetypes. The final section of this chapter presents strategic interventions based on these knowledge dynamics for improved innovative capability.

Section 9.2 presents the archetypes and identifies their knowledge dynamics and locates that knowledge using the cultural knowledge matrix. Implications to innovation capability are also discussed. In Section 9.3 intervention strategies that can facilitate the movement between these archetypes for improved innovation capability are looked at.

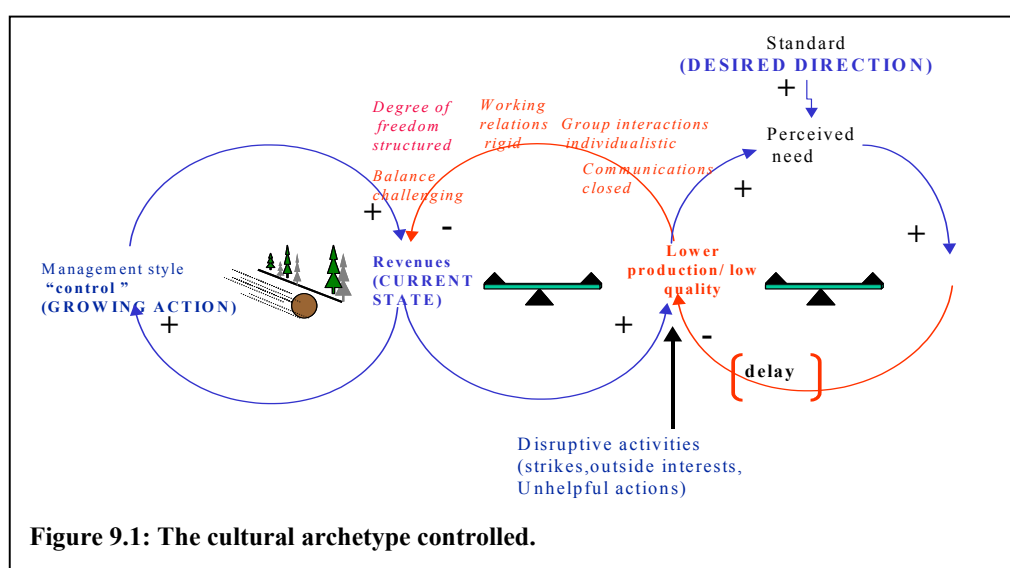
### 9.2 The cultural archetypes.

Using data collected through additional semi-structured interviews and the six cultural dimensions identified in Chapter Eight this section develops the cultural archetypes.

A total of further fourteen additional semi structured interviews were conducted with managers of the six research domains. The data derived from these was analysed to identify four management styles (control, overlooking, propping and empowered). These management styles were used in conjunction with the six cultural dimensions discussed in Chapter Eight to identify four cultural archetypes (controlled, fuzzy, empowering and cultivated). The knowledge dynamics of these archetypes were identified using the cultural knowledge matrix presented in Table 6.1 which also locates the knowledge within the eight layers of the repository of knowledge. This provided unique knowledge “fingerprints” of each cultural archetype which are discussed in relation to innovation capability.

### 9.2.1 Cultural archetype “A”- controlled.

This archetype is associated with short time focus, has closed communications, rigid working relations, is individualistic, position vulnerable, has extreme time pressures – cost cutting, is rule based and creativity is discouraged.



Domain “C” (old unit providing new services) has this archetype as its basic structure. It was a remnant of the old civil service culture, but its efforts in trying to understand the context within which technology was applied had begun to bridge the gap with the business end. This explains the movement (evolution) towards archetype “B” which is labelled the “fuzzy” archetype and is discussed in the next section. Part of Domain “A” (management) is also in this quadrant and this can be explained by the existence of the

“old guard” in some parts of the organisation. Data supporting this has been presented in Chapter Five.

This archetype has an elaborated “Limits to Growth” archetype (Billinger, 2001) structure where the slowing action is part of another balancing loop with an external standard and some delay (Figure 9.1). Innovation is more product oriented focusing on narrow processes and traditional product lines. Initially the management style “control” (*growing action*) influences an increase in revenue (*current state*). The increase in the current state then influences more of the growing action (*tightening control*), producing the reinforcing characteristic. As the current state moves in the desired direction, it influences the increase in a slowing action (manifested as lower production or loss of quality) due to the lack of communication, action being individualistic, working conditions becoming rigid leading to worker dissatisfaction.

*“Yes there is a lot of frustration. I think it is because (a) it is a hangover from the civil service days when everybody had an office no matter what rank, suit and tie behind the desk, civil service tradition, and b) this is a business that I don’t think is employee focused but focused on some shareholder value and profits. It is not in the business of encouraging people to enjoy life and to have good ideas. You are in the business of doing a day’s job and making sure of getting the value out of it. The sad thing is that there is no shortage of ideas and most of the people are talented, committed, motivated, work long hours and compensate for the lack of communication and flexibility in the environment here by working out of it”. Manager Domain C.*

*“We are tired... that has been recognized. We have worked hard to try to get the company to react to our concerns about the inability to get value out of the work we believe is sometimes there. That relates back to what I was saying about employee buy in. I think that it shows a contempt and disregard for your staff and employees really, and that shouldn’t happen. I think that should be done in a more consensus forming manner and it should be possible to change direction, to move on and to take people with you in a far more complex way than we are doing at the moment. It is the real problem that we have got and there are whole areas that are left behind and that is bad in a lot of different ways. I am trying to cost it in terms of innovation, I mean it probably means that you are not using your existing resources properly for innovation and you probably need to buy in innovation resources at this end where the new direction is taking you”. Manager Domain C.*

This slowing action subsequently impedes the movement of the current state in the desired direction. This system can be enabled to grow more if the slowing action is reduced. This can be done through intervention strategies such as increased communications between teams, or greater flexibility in work tasks. The net effect is that as the slowing action interacts with a defined standard (quality, production, revenues etc.)

there develops a perceived need for action. This results in the development of something, which will act as slowing avoidance (interventions), which will after some delay reduce the slowing action. This action can come either through interventions put in place by the management or it may at times be a result of action(s) by individuals who use their personal networks and influence to move things forward.

*“They get the flexibility they need to be creative in spite of the environment, in spite of the constraints in working here because they are required to perform at a certain level. So it is rather sad because with a bit of encouragement it could be a much more dynamic and productive place”. Manager Domain A.*

It is important to note that time and space plays an important part in the whole process. This becomes evident from the interaction of the slowing avoidance with the slowing action (effects on quality and production). The slowing action works in a shorter time frame reducing the current state thereby reducing the slowing action and eliminating the perceived need. As such the system becomes limited in its growth because the perceived need for action is actually undermined by the systems own actions. This is exemplified by the following example that reflects the “conflict” on one hand of putting in place interventions to increase flexibility and a desire to maintain control on the other.

*“Our aspirations are to keep ahead and be proactive in the market rather than reactive which means we have got to be that much more flexible. Obviously the more flexible and flatter the organisation the harder it is to keep track of what is going on. Within a large organisation it is harder to control and there is also a lot of debate at very senior level about how much control is required. Obviously control is a two edged sword”. Manager Domain A.*

Taylorism both advanced and froze management thinking with its ‘scientific approach’ that was task focused and subjected the worker and organisation to a mechanistic interpretation. The principles of this approach attempt to codify worker experience and skills into objective scientific knowledge. This style of management can result in creative abilities being directed towards the disruption of innovation.

The requirement to ‘drive out fear’ is a critical step toward bringing innovation to the workplace.

*“You have got to accept that mistakes will be made. I am not sure that the organisation at the present stage accepts that. It has to accept that if you make mistakes you have to live with them. At the back of my mind there is this worry and fear of making a mistake”. Manager Domain C.*

However the formal innovation in this cultural style is largely product-oriented, contained and inward focused.

*“With a lot of research that was done originally, the company knew what it wanted. This is what the company wants, go and make it ”. Manager Domain A.*

Mintzberg (1979) refers to this as “sealing off the operating core from disruptive environmental influences”.

*“One of the issues is, if you look at some disruptive innovation, that is going to change things...the problem - you know they have to take a real risk on you and the BT processes don't allow that to happen”. Manager Domain C.*

Innovation in this context may well ease individual and collective work tasks with a potential benefit for the company however at best these benefits are unlikely to be recognized as a product of innovative practice and at worst the innovative behaviour may be penalized for stepping outside of accepted practice.

*“They do not want their customers to be confused by us technologists telling them about the future and all the lovely things that they are going to be doing because it “muddies” the water”. Manager Domain C.*

An alternative scenario within this archetype might be the focusing of innovative capability towards behaviours that circumvent accepted practice for the benefit of the individual and or group rather than the organisation as a whole.

*“To be honest I have completely changed in the last ten years. Sometimes you do what you think is right, if its wrong, do something else that is of interest to the team and take the flak for it”. Manager Domain C.*

The knowledge within this archetype is “encoded” and is depicted by the shaded area in the cultural knowledge matrix (Table 9.1). Knowledge is not held by individuals thereby reducing the dependence of the organisation on those individuals. Rather it is held by the organisational structures that are responsible for forming the rules and processes. There is a separation of the knowledge that is required for carrying out the operations of the organisation from those that are necessary for its generation and renewal.

*“But then you get people who have got good ideas that are not caught in their working area which might be original, maybe out of it, or nothing to do with it whatsoever. They were a bright innovative team and they kept having off the wall ideas. All were keen to make money and they were all coming with ideas, some of them were doing it in their own time at home, you know in the garage hoping to make money, and others related to BT and one of the two worked with the new ideas scheme to get their ideas accepted. I would say on the whole at that time, I am talking 8-10 years ago, that the response was negative. Their perceptions of the new idea scheme, operated then was not good and they felt cheated at the end of the process”. Manager Domain A.*

*“I know that parts of the business where innovation would be looked at with suspicion because they are charged with delivering a product, a bound product and making sure it works, and following procedures is very important because they want to make sure that the quality is right”. Manager Domain C.*



Knowledge is therefore scattered and fragmented at an operational level and is only consolidated at management level. Organisational structure and the management information systems become the knowledge itself (Bonara and Revang, 1993). The abstraction of individual's experience and knowledge into encoded knowledge also facilitates centralization and control in organisations (Lam, 2000).

The encoded knowledge is inevitably simplified and selective and fails to capture and preserve the tacit skills and judgement of individuals. This inflexible archetype has difficulties with spontaneous change and is not effective in the creation of new knowledge. Rogers (1983) exemplifies this when describing stage model research. Stages tend to occur in the expected order when a simple innovation is borrowed or adapted from an external source. However, when innovations are complex and / or originate from within an organisation, stages tend to be muddled up and overlapping. This is in large part due to the limited use of tacit knowledge. The implications of this are that a controlled archetype would be unable to develop complex innovations and to adapt complex innovations from its environment.

	Embrained Formal, abstract or theoretical knowledge "universal laws" Individual explicit	Embodied Action oriented -Context specific  Individual tacit	Encoded Signs and signals Information  Collective explicit	Embedded Knowledge in systemic routines  Collective tacit	Encultured Shared understanding  Collective explicit
Environment				X <i>Tacit</i>	
Mission, vision & Values			X <i>Explicit</i>	X <i>Tacit</i>	
Technology			X <i>Explicit</i>	X <i>Tacit</i>	
Knowledge structures	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
Management style org. structure.	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
The Individual	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit</i>	X <i>Tacit</i>	
The collective	X <i>Explicit</i>	X <i>Tacit</i>		X <i>Tacit</i>	X <i>Tacit</i>
Organizational memory			X <i>Explicit</i>	X <i>Tacit</i>	

**Table 9.1: The cultural knowledge matrix of the archetype controlled.**

The characteristics and nature of the cultural type "controlled" are summarized in Table 9.2.

	<b>Draws knowledge from</b>	<b>Knowledge structure</b>	<b>Implications to organizational learning</b>
<b>Controlled</b> Collective and explicit <b>Dominant</b> <b>Knowledge type</b> Encoded knowledge <b>“formal innovation in is largely product-oriented, contained and inward focused</b>  <i>“This inflexible archetype has difficulties with spontaneous change and is not effective in the creation of new knowledge. This is in large part due to the limited use of tacit knowledge.”</i>  <b>Motivation extrinsic</b>	<ul style="list-style-type: none"> <li>•Knowledge is drawn from rules and processes distant from the users.</li> <li>•There is a separation of the knowledge that is required for carrying out the operations of the organization from its generation and renewal</li> <li>•The organizational structure and the management information systems become the knowledge itself</li> </ul>	<ul style="list-style-type: none"> <li>•Individuals do not hold the knowledge which is held by the organizational structures that are responsible for forming the rules and processes.</li> <li>•Knowledge is therefore scattered and fragmented at an operational level and is only consolidated at management level</li> </ul>	<ul style="list-style-type: none"> <li>•There is lack of flexibility, and it is difficult to deal with change spontaneously.</li> <li>•It is not effective in the creation of new knowledge, especially as tacit knowledge is hardly used.</li> <li>•The encoded knowledge is inevitably simplified and selective and fails to capture and preserve the tacit skills and judgment of individuals</li> </ul>

**Table 9.2: Summary characteristics of archetype controlled.**

### 9.2.2 Cultural archetype “B” – fuzzy.

This archetype has a long-term focus is on big issues and has closed communications. It is individualistic, protected, has with rigid working relations, is rule based and allows some creativity.

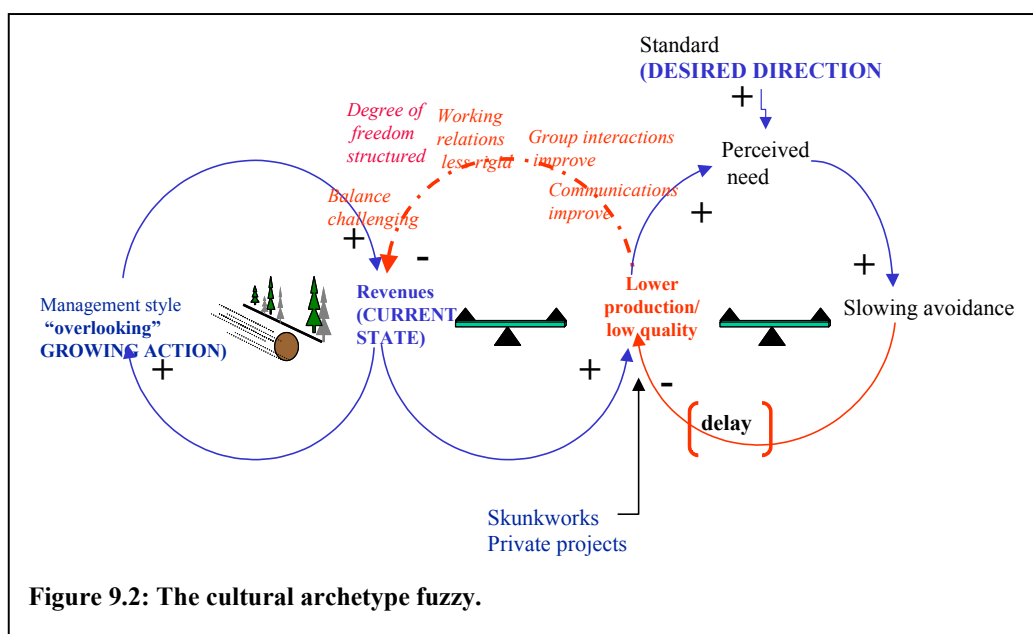
Domains “A” (management) and “C” (old unit providing new services) share characteristics of this archetype which is different from the previous controlled archetype in the structure of the middle loop – the slowing action loop. The difference between the slowing action and the current state decreases slightly due to changes in the cultural dimensions. This is depicted in the archetype drawing by a dotted line (Figure 9.2).

When a ‘fuzzy’ approach is adopted towards innovation the basic culture allows some creativity but provides limited assistance for, or direction to, the task.

*“I am thinking about things like encouraging people to be innovative and getting managers, engineers and ourselves together to share their experiences”. Manager Domain C.*

This can have a significant effect on the innovation process with the existence of unofficial projects where people are allowed to work on their ‘pet’ ideas. The “skunk-works” model popularised by Peters and Waterman (1982) is an example of a fuzzy archetype that allows individuals to work on projects in their own time or outside the main research activity of the group or organisation.

*“.... and we ought to mention this, a lot of the ideas we have worked on we would call “skunk” projects. This means that they were projects which were not part of a written down project, proposal” Manager Domain C.*



Skunk-works, and indeed most innovation within this archetype seem to work largely through intrinsic motivation. As Kohn (1995) has shown, promised reward is neither a motivator nor a guarantee of innovative success. The improvised style of the typical skunk-works seems to be an important ingredient for creativity. For such private projects to work, the domain of innovation needs to be aligned to the skills and interests of the people working on them.

*“... within that obviously we have technical experts who have their own ideas and their own world view and they feed us some of the technology push”. Manager Domain A.*

Although the “fuzzy” archetype allows a higher degree of autonomy to individuals, its structures are still bureaucratic.

*“I actually ran a large development unit and I would say the majority of the good ideas were implemented within that unit because there were ways of cutting out unnecessary tasks so that we could do things with less people quicker, get a product out quicker”. Manager Domain A.*

	Embrained Formal, abstract or theoretical knowledge “universal laws” Individual explicit	Embodied Action oriented -Context specific  Individual tacit	Encoded Signs and signals Information  Collective explicit	Embedded Knowledge in systemic routines  Collective tacit	Encultured Shared understanding  Collective explicit
Environment				X <i>Tacit</i>	
Mission, vision & Values			X <i>Explicit.</i>	X <i>Tacit</i>	
Technology			X <i>Explicit</i>	X <i>Tacit</i>	
Knowledge structures	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
Management style org. structure.	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit.</i>	X <i>Tacit</i>	X <i>Tacit</i>
The Individual	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit.</i>	X <i>Tacit.</i>	
The collective	X <i>Explicit</i>	X <i>Tacit.</i>		X <i>Tacit.</i>	X <i>Tacit</i>
Organizational memory			X <i>Explicit.</i>	X <i>Tacit.</i>	

**Table 9.3: The cultural knowledge matrix of the archetype fuzzy.**

Controls remain in place and co-ordination is achieved “by design and by standards that predetermine what is to be done” (Mintzberg, 1979). This causes tension between on the one hand encouraging more participation in the innovation process (encouraging creativity) and on the other putting into place unnecessary controls to direct innovation activity in a particular direction.

*“There will be project managers and programme managers who as far as I am concerned do not serve a useful function. They are a nuisance and no doubt they will have a different view. Basically that is the link between the project manager and customer, but there are a lot of extra people involved in the programme. I think it is unnecessarily complicated”. Manager Domain C.*

The nature of the “fuzzy” archetype also makes it unlikely that the organisation will learn from the process even if it does succeed in developing the products of such innovation.

The shaded areas in the knowledge matrix of this archetype (Table 9.3) indicates that this archetype comprises of both encoded and embrained knowledge. Embrained knowledge provides the competence that forms the basis of internal work rules, job descriptions and

status. Embrained knowledge is knowledge that is dependent upon conceptual skills and cognitive abilities (what Ryles, (1949) called “knowledge that” and James, (1950), as “knowledge about”).

	<b>Draws knowledge from</b>	<b>Knowledge structure</b>	<b>Implications to organizational learning</b>
<b>Fuzzy</b> Knowledge is individual and explicit <b>Dominant knowledge type is embrained</b>  <b>“approach towards innovation allows creativity but provides limited assistance or direction with the task”</b>  <i>“ this archetype is also not good at spontaneous change but is more adept to limited organizational learning within the boundaries of specialist knowledge”</i>  <b>Motivation is intrinsic</b>	<ul style="list-style-type: none"> <li>•The individual experts have a higher degree of autonomy and discretion in the application and acquisition of knowledge within their own specialist areas.</li> <li>•The organization assigns specialist tasks to individuals and groups and loses the capability to work outside of those specialist areas.</li> </ul>	<ul style="list-style-type: none"> <li>•The knowledge structure is individualistic, functionally segmented and hierarchical</li> <li>•The key knowledge agents are the trained experts who apply an existing body of abstract knowledge in a consistent and ‘logical’ manner</li> </ul>	<ul style="list-style-type: none"> <li>•Organizational learning is constrained within the boundaries of the formal specialist knowledge, as tacit knowledge is restricted</li> <li>•The sharing and dissemination of knowledge across boundaries is limited with the uncertainty in problem solving remaining contained within specialist boundaries</li> <li>•There is a lack of shared perspective and this inhibits both the transfer of non-routine tacit knowledge in day-to-day work and the interaction and sharing of knowledge with “non” experts</li> </ul>

**Table 9.4: A summary of the characteristics of the archetype “fuzzy”.**

The knowledge structure is individualistic, functionally segmented and hierarchical and individual experts have a higher degree of autonomy and discretion in the application and acquisition of knowledge within their own specialist areas.

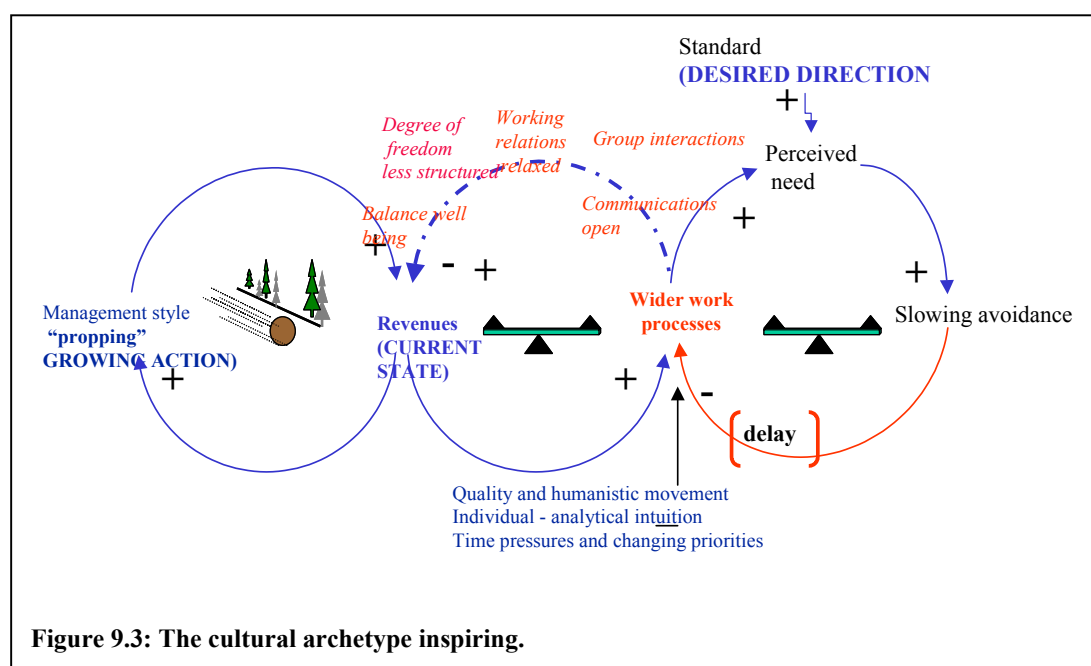
The sharing and dissemination of knowledge across boundaries is however limited (Lam, 2000) with the uncertainty in problem solving remaining contained within specialist boundaries. Mintzberg (1979) refers to this process as “pigeonholing” whereby the organisation assigns specialist tasks to individuals and groups and loses the capability to work outside of those specialist areas. The organisation loses this knowledge when these specialists leave the organisation. The key knowledge agents are the trained experts who apply an existing body of abstract knowledge in a consistent and ‘logical’ manner. This restricts the use of tacit knowledge and judgement skills for dealing with uncertainty in problem solving (Lam, 2000).

While formal expert knowledge entails “perceptual filters” (Starbuck, 1992) there is a lack of shared perspective and this inhibits both the transfer of non-routine tacit knowledge in day-to-day work and the interaction and sharing of knowledge with “non” experts (Lam, 2000). This lack of co-ordination creates problems for the innovation process with organisational learning being limited by the existing levels of formally acquired specialist knowledge and the restricted use of tacit knowledge.

The idea of “knowledge intensive firms” emphasizes the significance of “esoteric expertise” over commonplace, readily accessible, knowledge and illustrates the idiosyncratic nature of the knowledge base (Starbuck, 1992). The characteristics of this archetype have been summarized as in Table 9.4.

### 9.2.3 Cultural archetype “C” – inspiring.

This archetype (Figure 9.3) has short time horizons, individual responsibility and autonomy, open communications and group interactions, informal relations with management and protected positions.



Domains B, (strategic tools), D (exploitation), and E (new services) fall under this classification which is characterised by a shift from a balancing structure in the middle loop towards a double reinforcing structure. This indicates that the “opening up” of the cultural dimensions is narrowing the “gap” between the actual and the desired outcomes

of innovation activity. Although the communications have started to improve with the associated effects on employee satisfaction but there is still an element of “confusion”.

*“The processes are there just to give you a light structure, just to give people an understanding, the feel, strategy of what is going on”. Manager Domain B.*

This is depicted in the balancing structure by a dotted line. The effect is shown as a +/- which indicates that the balancing and the reinforcing structures are at par. Within an ‘inspiring’ R&D culture the skills that support creativity are actively sought as the innovation worldview has expanded from a product focus towards multiple work processes.

*“The culture is changing very rapidly. Now you see there is far more interaction between product lines. So the traditional product line that had its own identity with quite clear boundaries is disappearing. Product lines cannot survive on their own”. Manager Domain A*

There is less standardization than in the controlled model of innovation and the organisation is more responsive to new ideas and open to alternative ways of working. Individuals have greater autonomy and more discretion in how they undertake their work and there is a more enthusiastic approach to experimentation and interactive problem solving.

*“It was a wasteful environment and innovation was not required and now looking back one or two years in BT, certainly my experience has been that if you can show people that not only is it all right to innovate, but it is positively encouraged. If it is a requirement to innovate, then everyone can do so willingly and enjoy to innovate”. Manager Domain A.*

The concept of Total Quality Management triggered many such efforts to move from a ‘controlled’ to an ‘inspiring’ style of innovation. This often followed an analytical approach with quality being measured, root causes identified and innovative solutions found in response to the underlying problem. The primary tool underpinning this model has been brainstorming. This can be less efficient than individual critical thinking because it encourages an organisation to focus on the less difficult of their problems rather than those that are more complex and long term and in need of a more creative approach.

This is a fundamental shift away from a focus on re-engineering and could be perceived as a retrogressive step with intrinsic motivation being replaced by an extrinsic reward system for improvements made. The linking of reward systems to savings can be expensive and result in a focus on immediate reward rather than longer-term and whole

company benefits. This archetype draws on the formal knowledge of an organisation's members – embodied knowledge - alongside the embodied practical problem solving skills of external experts. The shaded area in the knowledge matrix (Table 9.5) depicts this. Embodied knowledge is action oriented and is likely to be only partly explicit (Ryles, (1949) called it “ knowledge how”, and James (1950), “knowledge of acquaintance”). Greater tacit knowledge is generated through experimentation and problem solving. This supports the concept of “know-how” companies, in which technical and managerial expertise is integrated, and points to the broad-based and varied nature of knowledge required by the organisation (Sveiby and Lloyds, 1987).

	Embrained Formal, abstract or theoretical knowledge “universal laws” Individual explicit	Embodied Action oriented -Context specific Individual tacit	Encoded Signs and signals Information Collective explicit	Embedded Knowledge in systemic routines Collective tacit	Encultured Shared understanding Collective explicit
Environment				X <i>Tacit</i>	
Mission, vision & Values			X <i>Explicit.</i>	X <i>Tacit</i>	
Technology			X <i>Explicit</i>	X <i>Tacit</i>	
Knowledge structures	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
Management style org. structure.	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit.</i>	X <i>Tacit</i>	X <i>Tacit</i>
The Individual	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit.</i>	X <i>Tacit.</i>	
The collective	X <i>Explicit</i>	X <i>Tacit.</i>		X <i>Tacit.</i>	X <i>Tacit</i>
Organizational memory			X <i>Explicit.</i>	X <i>Tacit.</i>	

**Table 9.5: The cultural knowledge matrix of the archetype inspiring.**

The capacity to react to changing situations is a key characteristic of this cultural archetype in which the knowledge structure is individualistic but collaborative (as the focus shifts towards multiple work processes). Argyris and Schon (1970) and Senge (1990) refer to this process of learning to execute specified behaviours as “single loop” or “adaptive” learning. Lam (2000) refers to the importance of embodied skills and “know-how” competencies. Hirschhorn’s (1984) analysis of mechanization and his conclusions that operator’s tacit understandings of machine systems are more important than their



general knowledge, and Suchman's (1987) studies of how people spontaneously construct interpretations of technologies as they interact with them are other accounts of the application of embodied knowledge.

An increase in information flows due to increased interaction between workers is characteristic of this archetype and internal political support for Domain D has already been seen to be a powerful driver in Chapter Seven. Ancona and Caldwell (1992) have advanced an understanding of the role of political process and the significance of information flows and communication to successful product development. Sacko (1992, 1998) highlights the political processes involved in learning and trust building in the context of developing new products and general collaboration within and between firms. Coombs (1996) has shown that in the investment mode, the product of the R&D activity is technology seen as knowledge and skills (formal abstract representation of technology in codified form, the capabilities to employ it, the related embodied tacit knowledge). The transition from the exploratory to the development state in R&D is explained by the sharp growth of expenditure and by a strong difference in terms of risk (Kodama, 1995). This suggests that organisations with limited resources tend to move from the controlled or fuzzy archetype to an inspiring archetype in the development phases of the R&D process. Learning occurs as experts of diverse fields jointly solve problems. This is similar to the process identified by Leonard-Barton (1995) where knowledge building takes place through individuals with diverse signature skills working together on the solution of a problem. Through experimentation and prototyping the organisation is able to extend its existing capabilities and to build new ones for the future. As these competencies are embodied in an organisation they also cease to be exclusive. Starbuck (1992) refers to the "porous boundaries" of knowledge intensive firms and suggests that they find it hard to retain unique expertise. The essential characteristics of the cultural archetype "inspiring" have been summarized in Table 9.6.

As the organisation widens its knowledge base through expertise gained from its activities more resources are expended in building on this knowledge base and in making innovation the central focus of the organisation. This facilitates the movement towards the "cultivated" archetype, a process that requires linking other knowledge sources within and outside the organisation. O'Dell and Grayson (1998), Stoneman (1995), and Winter (1987) examined the "integrative capabilities" of an organisation and how those

capabilities were necessary for the flexible (re)combination of knowledge and expertise for innovation. Teece and Pisano (1994) have shown that continuous improvement can be considered as an example of dynamic capabilities.

	<b>Draws knowledge from</b>	<b>Knowledge structure</b>	<b>Implications to organizational learning</b>
<b>Inspiring</b> Knowledge is individual and tacit <b>Dominant knowledge is embodied</b> <b>“innovation worldview has expanded from a product focus towards multiple work processes”</b>  <i>“The capacity to react to changing situations is a key characteristic of this cultural archetype”</i>  <b>Motivation is extrinsic</b>	<ul style="list-style-type: none"> <li>• It draws formal knowledge of its members and embodied practical problem solving skills of external experts.</li> <li>• The idea of “knowledge intensive firms” emphasizes the significance of “esoteric expertise” over commonplace, readily accessible, knowledge and illustrates the idiosyncratic nature of the knowledge base</li> </ul>	<ul style="list-style-type: none"> <li>• The knowledge structure is individualistic but collaborative.</li> <li>• This supports the concept of “know – how” companies, in which technical and managerial expertise are integrated, and points to the broad-based and varied nature of knowledge required by the organization</li> </ul>	<ul style="list-style-type: none"> <li>• Through experimentation and problem solving, greater tacit knowledge is generated.</li> <li>• Learning occurs as experts of diverse fields jointly solve problems.</li> <li>• As these competencies are embodied in an organization they also cease to be exclusive.</li> <li>• They find it hard to retain unique expertise (porous boundaries)</li> </ul>

**Table 9.6: Summary characteristics of archetype inspiring.**

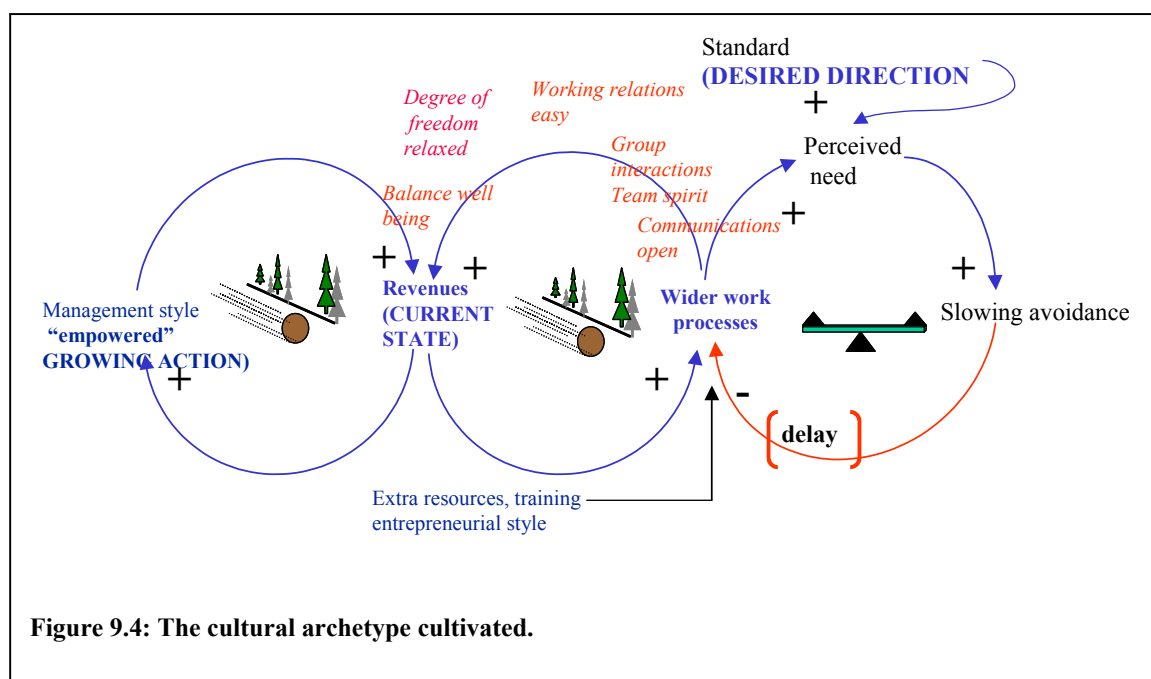
Bessant (1998) defines continuous improvement as “an organisation-wide process of focused and sustained incremental innovation” and offers “the element of dynamic capability whereby a large proportion of the organisation becomes involved in its innovation and learning process”.

#### **9.2.4 Cultural archetype “D” – cultivated.**

This archetype (Figure 9.4), focuses on the big issues over a long time frame, has high levels of autonomy and low levels of risk aversion, an empowering management style, and a secure working environment.

Domain “F” (new services) falls under this classification while Domains “B” (strategic tools) and “D” (exploitation) have started to make a shift towards this archetype. This archetype is markedly different from the previous inspiring archetype as there are now two reinforcing structures as the link between slowing *action (wider work process)* and the *current state (revenue)* becomes a positive feedback due to extra resources and

training. This link changes to a positive feedback as communications opens and there is team spirit and employee empowerment.



**Figure 9.4: The cultural archetype cultivated.**

*"Now I feel I have a fair deal of autonomy, I was given the task, go do XX, and I feel free to do as I wish providing that the work I am doing is related to XX. I will try to find money where I can and, will develop techniques that I see are appropriate". Manager Domain F.*

The 'cultivated' cultural archetype incorporates innovation as a critical process in its own right with a focus on the long-term and the whole organisation rather than the group responsible for carrying out the work. This over-rides the restrictive cost centered approach that might predominate in other models. In order to increase creative and innovative competences people are trained on a range of tools and techniques, either to stimulate general creative thinking or for specific use within creative problem solving. In many ways the transition from the inspiring to cultivated archetypes is not as difficult as previous transitions because it requires limited cultural change although increased creativity may require more open communication and trust than was previously the case. It is important to note that this 'empowered' style of innovation is also capable of undertaking some directed and product oriented work because of the relationships and trust that are built into the team.

The controlled archetype, by comparison, is likely to be incapable of undertaking work that is creative, relatively unstructured and grounded in competence (skills) and relationship forms of reciprocal trust (Newell and Swan, 2000). Orr's (1990) account of stories shared by maintenance technicians about complex mechanical problems and Nonaka's (1991,1994) work on knowledge creating organisations are contributions to this concept. A significant number of the workforce is involved in systematic problem finding and solving. This is what is referred to as "double loop" learning (Argyris and Schon (1970) or what Senge (1990) refers to as "generative" learning. The writings of Bateson (1973) on types of learning, especially his theory of "deutero-learning", or learning to learn provides an understanding of organisational learning within this cultural archetype. Gardner (1963) used the term "self renewal" and Lippitt (1969) "organisational renewal", to capture this living, learning quality. The recent interest in the learning company begins with Argyris and Schon's *Organisational Learning* (1978). The idea was picked up but not developed by Peters and Waterman (1978) when they said, "the excellent companies are learning organisations".

	Embrained Formal, abstract or theoretical knowledge "universal laws" Individual explicit	Embodied Action oriented -Context specific Individual tacit	Encoded Signs and signals Information Collective explicit	Embedded Knowledge in systemic routines Collective tacit	Encultured Shared understanding Collective explicit
Environment				X <i>Tacit</i>	
Mission, vision &Values			X <i>Explicit.</i>	X <i>Tacit</i>	
Technology			X <i>Explicit</i>	X <i>Tacit</i>	
Knowledge structures	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Tacit</i>
Management style org.structure.	X <i>Explicit</i>	X <i>Tacit.</i>	X <i>Explicit.</i>	X <i>Tacit</i>	X <i>Tacit</i>
The Individual	X <i>Explicit</i>	X <i>Tacit</i>	X <i>Explicit.</i>	X <i>Tacit.</i>	
The collective	X <i>Explicit</i>	X <i>Tacit.</i>		X <i>Tacit.</i>	X <i>Tacit</i>
Organizational memory			X <i>Explicit.</i>	X <i>Tacit.</i>	

**Table 9.7: The cultural knowledge matrix for the archetype cultivated.**

Table 9.7 is the knowledge matrix of this archetype and shows knowledge to be embedded and encultured within the operating routines of an organisation. Nelson and Winter (1982) while analysing an organisation's capabilities noted that individual skills are composed of sub elements which become coordinated in a smooth execution of the overall performance, impressive in its speed and accuracy with conscious deliberation being confined to matters of overall importance. This, they maintain was a way of analysing an organisation's skills.

There is a shared culture and a strong interaction between different types of knowledge. Leonard-Barton (1995) has shown that cultural knowledge provides the values and norms that determine what kinds of knowledge are sought and nurtured, what kinds of knowledge building activities are tolerated and encouraged. These include systems of caste and status, rituals and behaviour, and passionate beliefs associated with various kinds of technological knowledge that are as rigid and complex as those associated with religion. Therefore, values serve as "knowledge-screening and control mechanisms".

Embedded knowledge is relation specific, contextual and dispersed. It is organic and dynamic, an emergent form of knowledge capable of supporting complex patterns of interaction in the absence of written rules.

*"The skill I bring is my knowledge and the outside context and if we mesh the two, it is the knowledge of who to go to. To break processes and to break the rules is an important part of making this happen".*  
Manager Domain F.

This is similar to *knowledge conversion* (Nonaka and Takeuchi, 1995) where the organisation produces new knowledge and creative insight by moving between the personal, tacit knowledge of individuals and the shared explicit knowledge, which the organisation needs to develop new products and innovations. Both Badaracco (1991) and Wikstrom and Normann (1994) have shown how organisations link knowledge through (i) the formation of intimate learning alliances with other organisations in order to transfer knowledge that is situated in specialized relationships, work cultures, and operating styles of the partner organisation and (ii) how an organisation is a knowledge creating value star at the centre of many incoming flows of knowledge from suppliers, customers, and other partners.

Similarly Coombs and Hull (1997) and Coombs *et al.* (1998), in a discussion about knowledge management practices (KMP) talk about path dependency as "located" in

three distinct “domains” of the firm: (i) “technology-as-hardware” (ii) the “knowledge base” of the firm (relating to products, production systems and its market environment) and (iii) the “routines” which are used to “develop and apply the knowledge base of the firm”.

	<b>Draws knowledge from</b>	<b>Knowledge structure</b>	<b>Implications to organizational learning</b>
<b>Cultivated</b> Knowledge is both explicit and tacit  <b>Dominant Knowledge type</b> Embedded and encultured knowledge  <b>“innovation is a critical process in its own right with a focus on the long-term and the whole organization”</b>  <i>“This archetype is very adept at responding to challenges, both internally and externally”</i>  <b>Both intrinsic and extrinsic motivation are important.</b>	•From shared culture, operating routines and various networks of communities and teams working together	•Knowledge structure is collaborative	•Learning takes place through shared work experiences and joint problem solving through strong interaction between the different types of knowledge.  •It produces new knowledge and creative insight by moving between the personal, tacit knowledge of individuals and the shared explicit knowledge which the organization needs to develop new products and innovations

**Table 9.8: Summary characteristics of archetype cultivated.**

Tornatzsky and Fleisher (1990) in stage model research, have shown that organizing innovation is not simple or linear, but is rather a complex interactive process having many feedback and feed forward cycles. The output of R&D activity in the harvesting mode, is a functionality profile and a technological recipe (the choice of the particular combination of technologies, design practices, configurations of sub systems able to provide a certain range of service and performance (Coombs, 1996).

The essential characteristics of the cultural archetype “inspiring” have been summarized in Table 9.8.

The next section discusses managing the transition between archetypes. It will show that there is not necessarily a qualitative improvement as one moves from a controlled culture

for innovation towards a cultivated archetype. Rather the difference between archetypes is determined by the current organisational position. For example the cultivated archetype will incorporate the attributes of the other archetypes and it should be possible to draw upon these when a more structured approach is required. In contrast a controlled innovation culture will not include the attributes that are necessary for operating according to the other archetypes. The transition in this direction will require the acquisition of new attributes as opposed to the selection of, and reconfiguration from, those that are already evident. Consequently, it is also important to consider strategies for actively maintaining an existing archetype when this is considered to be appropriate.

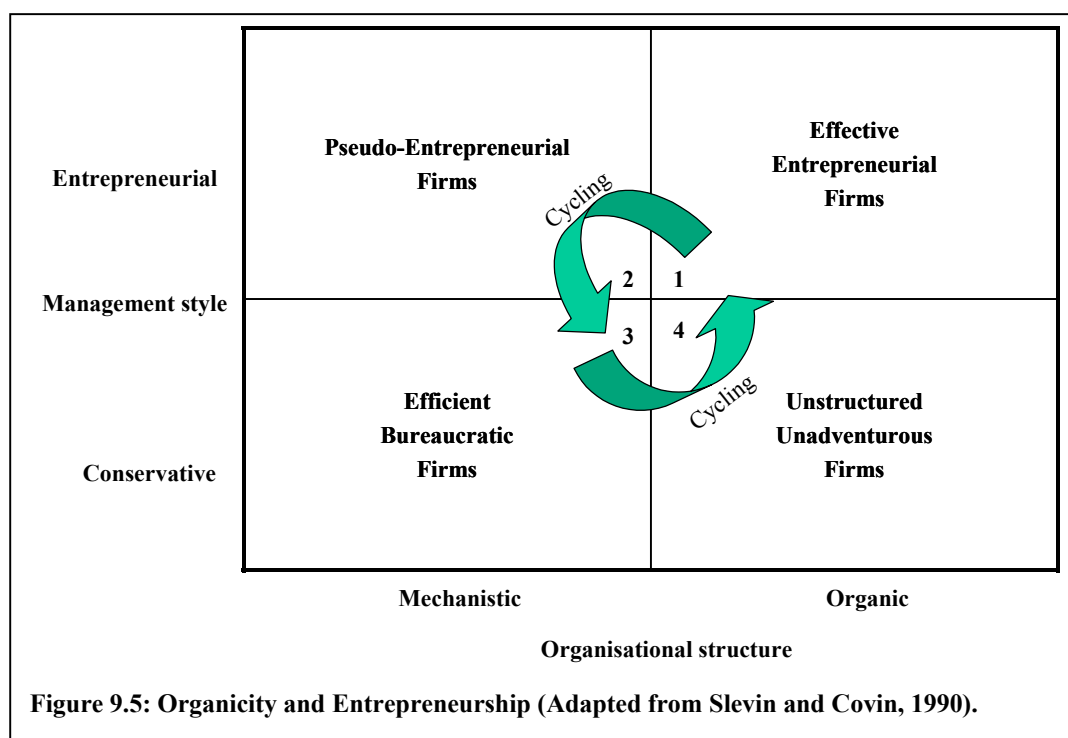
### **9.3 Managing the transition.**

Cultures come in many forms even within one organisation, they come into being for many reasons and are evolving all the time. Change is a fundamental reality, and organisations suffer because they attempt to “solidify” their existing situation. For organisational cultures to evolve they must be able to respond to the conditions of uncertainty generated by the multiple perceptions and systemic interactions that constitute context (Senge, 1990; Eden and Ackerman, 1998).

Slevin and Covin (1990) explored the balance between the organisational structure of the firm and the type of entrepreneurial behaviour in which it engaged and outlined the key elements in this balance. They define entrepreneurial behaviour and organisational structure, and describe the model that relates these variables to each other (Figure 9.5). Entrepreneurship represents organisational behaviour and includes risk taking (the willingness to pursue opportunities boldly and aggressively), proactivity (the willingness to initiate actions to which competitors then respond) and innovation (the willingness to place strong emphasis on R&D, new products and services) on the part of the organisation. Appropriate organisational culture and management structures are required to support such behaviours. A balance between entrepreneurial behaviour and organic organisational structure is maintained through effective management.

Figure 9.5 portrays the organisational structure of Slevin and Covin’s model as mechanistic or organic on the x-axis while the y-axis portrays the management style as entrepreneurial or conservative resulting in four cells (Slevin and Covin, 1990). These cells have some similarity to the four archetypes identified in this thesis. Cell 1 for

example is similar to the cultivated archetype, Cell 2 to the fuzzy, Cell 3 to the controlled archetype, and Cell 4 to the inspiring archetype.

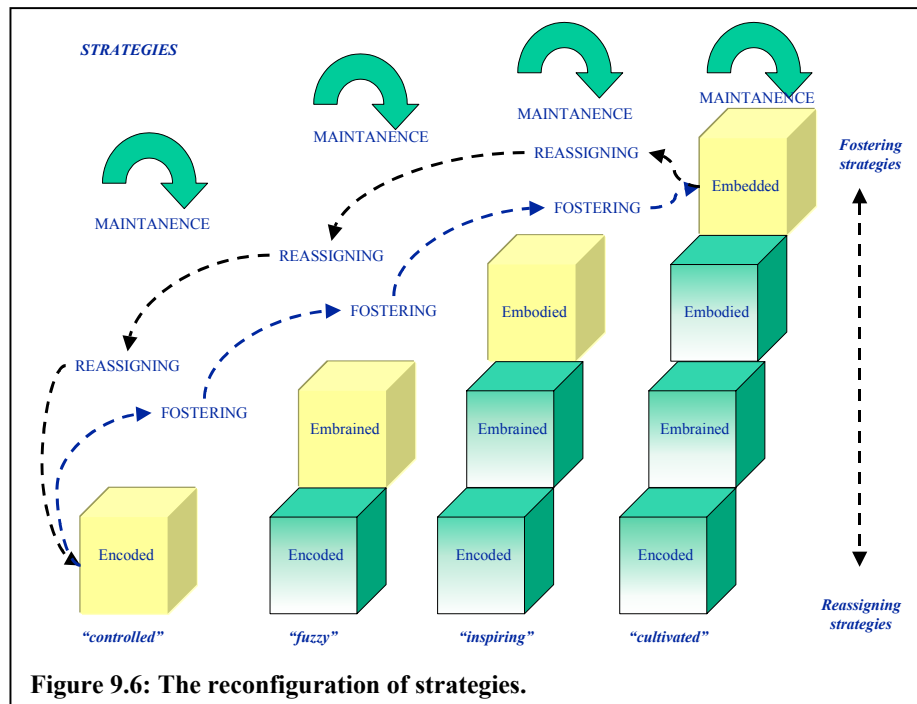


The cell position occupied by a firm is influenced by the forces from the firm's environment and this bears similarity to this research. The movement between these cells is in response to these environmental forces. For example Slevin and Covin found that in hostile environments, higher-performing firms have more organic structures and this was attributed to the fact that hostile environments often require fast reactions on the part of an organisation. This is achieved through a high level of informality with emphasis on open communications. To summarise Slevin and Covin (1990) show the interrelatedness of environmental hostility, entrepreneurial behaviour and organisational structure. This results in the movement between the four cells and the resultant adaptation of the firm. Slevin and Covin (1990) refer this to as "cycling behaviour" and present studies by other authors who have written about similar behaviour. Tushman (as cited by Slevin and Covin, 1990) observed that "successful firms proceed through periods of stability and conservatism followed by periods of innovation and rapid system wide change". This was achieved by adjusting organisational system elements, including organisational structure into a "congruent pattern". Maidique and Hayes (as cited by Slevin and Covin, 1990)



found that high-technology firms “manage differently at different times in the evolutionary cycle of the firm”. The successful high-technology firm alternates periods of consolidation and continuity with sharp reorientations that can lead to dramatic changes in the firm’s strategies, structure, controls, and distribution of power, followed by a period of consolidation”. Slevin and Covin (1990) suggest that the concept of cycling is not new to the practice of management and suggest that “it has a potential as a tool for effectively reconciling the needs for stability and innovation”. Management style variables (entrepreneurship) and organisational structure variables (organicity) can be balanced to optimise firm performance (Slevin and Covin (1990). This thesis through empirical research provides such a tool in the form of cultural adaptability in response to change.

While, these studies represents a more general view of organisational response (the forest view), this study takes a more in-depth view (the trees view) of looking at how organisational culture affects innovation capability and respond to changes in its environment. Four cultural archetypes with specific knowledge dynamics identified by this thesis provide a holistic, in-depth view of organisational culture particularly as it relates to innovation capability. It has been argued that organisational culture should be viewed as an adaptive and organic entity and should be managed as such. By doing so organisations can have the dynamic capability to meet unexpected challenges in their competitive environment. In Slevin and Covin’s (1990) model the movement between the four cells is in response to the environment. Similarly, different cultural archetypes are appropriate for different organisational contexts and the ability to move between archetypes is determined by the current position. It is important to reiterate that there is not necessarily a qualitative improvement as one moves from for instance a controlled culture archetype for innovation towards a cultivated archetype. The cultivated archetype will incorporate the attributes of the other archetypes and it should be possible to draw upon these when a more structured approach is required. In contrast a controlled innovation culture will not include the attributes that are necessary for operating according to the cultivated archetype (Figure 9.6). The transition in this direction will require the acquisition of new attributes as opposed to the selection of, and reconfiguration from, those that are already evident.



The movement from a cultivated archetype towards one exhibiting more control can be termed as ‘reassigning’ and the movement in the opposite direction as ‘fostering’ (Figure 9.7).

Cultural archetype	“A” <i>Controlled</i>	“B” <i>Fuzzy</i>	“C” <i>Inspiring</i>	“D” <i>Cultivated</i>
“D” <i>Cultivated</i>	Reassigning strategies <b>A. Embodied to encoded</b>	Reassigning strategies <b>B. Embodied to embrained</b>	Reassigning strategies <b>C. Embodied to embodied</b>	Maintenance Strategies <b>D</b>
“C” <i>Inspiring</i>	Reassigning strategies <b>E. Embodied to encoded</b>	Reassigning strategies <b>F. Embodied to embrained</b>	Maintenance Strategies <b>G</b>	Fostering strategies <b>F. Embodied to embodied</b>
“B” <i>Fuzzy</i>	Reassigning strategies <b>G. Embrained to encoded</b>	Maintenance Strategies <b>H</b>	Fostering Strategies <b>I. Embrained to embodied</b>	Fostering strategies <b>J. Embrained to embodied</b>
“A” <i>Controlled</i>	Maintenance Strategies <b>K</b>	Fostering Strategies <b>L. Encoded to embrained</b>	Fostering strategies <b>M. Encoded to embodied</b>	Fostering strategies <b>N. Encoded to embodied</b>

**Figure 9.7: The strategy matrix.**

While the organisational culture as it relates to innovation capability and the learning associated with it is dynamic it is also important to consider strategies for actively maintaining an existing archetype when this is considered to be appropriate.

### **9.3.1 Movement between archetypes.**

A reassigning strategy might be necessary in one of two situations. Firstly a change in which personnel and the related tacit knowledge is lost possibly as the result of downsizing, re-engineering, or a take-over. The recovery of this lost knowledge and skills might be facilitated through moving to a more controlled archetype involving formal training, clearly defined roles and competences. Leaders take charge, and organisational members' working lives are increasingly shaped by rules and contractual and competence as opposed to relationship trust. Secondly, a refocus away from creative activity and towards product development might be pursued with a more structured working environment and clearer direction from management.

The knowledge matrix for the controlled archetype suggests what strategic action might be required for this transition. The knowledge in the controlled archetype is explicit, collective and encoded. The mission statement provides a sense of direction as the management style exerts greater control by making the organisational structure bureaucratic. Fayol (1949) describes an "*esprit de corps*" and a sense that "union is strength". It is the executive function to promote this widespread belief in a common purpose. Barnard (1938) suggests that organisations are co-operative systems that have a unifying purpose. He continues that it is the belief that is important, not necessarily the detailed understanding of common purpose. Cyert and March (1963) and Thompson (1967) develop the notion of a core set of beliefs and values that serve as motivating reasons for individuals to join together in an organisation.

The knowledge structures are also closely linked to an organisation's strategy for survival and more subject to change. Changes in knowledge structures occur as a result of the impact of environmental events, past organisational actions, the influence of key decision makers and the advocacy positions of coalitions within the firm (Lyles and Schwenk, 1992). During the process of development, organisations with simple structures attempt to find segments of the environment in which they can operate without being traumatized by too many jolts (Meyer, 1982) Alternatively they will ignore the jolts, remaining unaffected by them and maintaining the viability of their structure. Lyles and Schwenk

(1992) propose that firms that have a structure that is tightly coupled i.e. the core (mission – knowledge about the most basic of the firm’s purposes and goals) and the peripheral (cause and effect belief structures – knowledge about sub goals and about their behaviour or steps to achieve those goals) need to maintain stability and to avoid jolts. They view knowledge structures as a combination of the mission and the shared perspective of the management core that are often treated as separate issues. This suggests that the mission and values of an organisation and the strategy to achieve those objectives should be clear in a controlled archetype. Consequently the firm will seek to maintain the status quo and avoid change. A firm with a tightly coupled structure will seek similar market conditions so that it can use the same business models. The key decision makers in tightly coupled firms are interested in reducing disagreement because it could lead to “uncoupling” and trauma for the firm. This suggests a “protectionist” or “shielding” responsibility for management.

It is important that when a strategy of greater control is implemented the work force is well informed. The reinforcing cycle of this controlled archetype leads to greater control measures and if the balancing process is not aligned to the benefit of the organisation, increased worker dissatisfaction will result. This should be a continuous process and in a format that is accessible and comprehensible to personnel aligned to interventions designed to increase extrinsic motivation and retain self-esteem under conditions of uncertainty.

An example of a fostering strategy is the movement from a “fuzzy” to “inspiring” archetype. This requires a shift from dominant embrained knowledge to that which is embodied and is typical of an organisation where there is decreasing standardization and a more responsive attitude to new ideas and ways of working. This might be exemplified by a shift from single to multiple work processes. The capacity to react to changing situations becomes a key characteristic and individuals have to be given greater autonomy and more discretion in how they undertake their work. This is aligned to a more enthusiastic attitude to experimentation and interactive problem solving. Skills that support creativity are actively sought as the innovation worldview expands. The formal knowledge of an organisation’s members, alongside the embodied practical problem solving skills of external experts, becomes increasingly necessary. Greater tacit

knowledge is generated through experimentation and problem solving capabilities and learning should occur as experts of diverse fields collectively solve problems.

The dominant knowledge type within the inspiring archetype is the action oriented, context specific embodied knowledge that is individual and tacit. As in the “fuzzy” archetype, this is found in individuals and teams however there is increased collaboration leading to the generation of new knowledge. Issues such as trust, empowerment, open communications, and a greater degree of freedom become essential in encouraging innovative activity through collaboration and individual satisfaction. Motivation becomes intrinsic and the knowledge structure more complex. This influences the ability of the organisation to respond to environmental change. Stored knowledge can become difficult to retrieve and what is retrieved depends on the frequency of use, how recently it was used, its usefulness and location alongside individual and group preferences and self-interest competence in retrieval (Douglas, 1986; Levitt and March, 1988; March and Olsen, 1975; March *et al.* 1991). More complex structures however allow for more diverse information to be recognized and processed. As the organisation gains more experience and learns from it, it becomes more expert at what it is doing and as a result is able to encompass a greater number of new situations and problems (Lyles and Schwenk, 1992). The strategy here regarding the mission, value and the knowledge structures is that of a loose coupling. Firms with a loosely coupled structure are more accepting of alternative interpretations about how to carry out the firm’s mission. Changes can be made more easily and there will be more flexibility of action. According to Weick (1979), environmental jolts do not affect such firms as greatly as tightly coupled ones. The firm can adjust its strategies with changing environmental conditions and the ability to incorporate new knowledge is increased.

In order to develop a successful strategy the communication channels need to be improved and worker empowerment should accompany more trust and risk taking. The style of management should become more participative with major decisions being taken in an increasingly collaborative and consultative manner. The individual motivation within this archetype is more intrinsic and supported by a conducive working environment, knowledge sharing tools and improved down streaming methods. Scanning and networking activities, such as attendance at seminars and conferences, and membership of communities of practice and interest should also be encouraged.

The cultivated cultural archetype is necessary when an organisation is operating in a knowledge intensive sector within a highly volatile and competitive environment. These organisations are in the business of creating added value through the exploitation of current activities, products and the skills embedded in the firm. The need to experiment and anticipate future trends is important. This links the exploitation of resources and the available knowledge base to compete in the short-term market place (exploitation programme) and leads to the development of knowledge that helps sustain this competition in the long run (experimentation programme). In order to meet these challenges the organisations have to be entrepreneurial. The dominant knowledge type of this archetype is embedded and encultured with an emphasis on collaboration, team working, and putting in place working practices that are conducive to creativity and innovation. Continuous double loop learning becomes the norm. Learning at the collective level also results from the interplay of individual and group knowledge through social interaction, team working and communities of practice. There is agreement that the collective knowledge that comprises embrained, embodied, encoded, and encultured knowledge is the most powerful strategically. The organisational memory, which is defined by Walsh and Ungson (1991) in its most basic sense as “stored information from an organisations’ history that can be brought to bear on present decisions”, has to be continually updated through learning. Failure to do so would result in the organisation slipping into the common attitudes that underpin “the not invented here” and “this is the way things are done around here” syndromes and becoming engrossed in self-perpetuating routines.

Social networks, both formal and informal, therefore have to be encouraged and the skills of individuals and teams should be continually upgraded through additional resources. The personal development of the knowledge worker through continued training is also important. The knowledge building (Leonard-Barton, 1995), knowledge conversion (Nonaka and Takeuchi, 1995) and knowledge linking activities (Badaracco, 1991; Wikstrom and Normann 1994) discussed in Chapter Five have to be made the routine.

#### **9.4 Conclusions.**

This chapter developed four cultural archetypes using the six cultural dimensions identified in Chapter Eight and from additional data collected through semi-structured interviews. The knowledge dynamics of these archetypes were identified and located

within the eight layers of the repository of knowledge. This provided unique “fingerprints” of each cultural archetype. The implications to innovation capability were also discussed. Transformational strategies that could facilitate the movement between these archetypes for improved innovation capability were presented next.

Chapter Ten is the final chapter of the thesis and provides a summary of what has been achieved by this study and relates that to the aim and objectives outlined in Section 1.4.3. It also evaluates the conceptual framework and presents the substantive findings and contributions to knowledge. After an appraisal of the chosen research method, the chapter concludes with a section on implications for further study.

## **Chapter 10: Conclusions, contributions and implications for further study.**

### **10.1 Introduction.**

This thesis has focused upon the ability of organisations to improve their innovation capability. For the purpose of the study this capability was defined as the propensity of the firm to innovate or what Rogers (1995) described as organisational innovativeness. Organisational culture and its ability to respond to changes in its operating environment was seen as an important determinant of innovation capability. This issue were central to the case study that was carried out in the innovation process of BT. Four key questions were raised by BT that were perceived to facilitate or constrain the process of innovation under differing conditions at BT. While the organisation recognised the value of innovation and the reliance of R & D upon it there were concerns that it failed to harness innovation effectively. It was also aware that there was no specific domain for innovation and was therefore unclear on how innovation entered the R & D process. The barriers and drivers to the process were not known. Innovation capability was thus an issue of concern and these formed the substantive research context for the work.

This chapter begins by summarising what has been achieved in the thesis and relates this to its aims and objectives. The theoretical and substantive contributions of the study are considered next followed by an appraisal of the chosen research method. The conceptual framework is then evaluated and the chapter concludes with a section on the implications for further research.

### **10.2 Summary of work and achievements.**

Earlier work undertaken between INTA and BT about how to improve the process of fostering and managing innovation was considered alongside the concerns of managers within the organisation and a set of initial aims and objectives were identified. These included the identification of competencies required for incorporating cultural characteristics into models of organisation efficiency and the development of expertise in strategy formulation specifically focused on cultural change. Knowledge was also identified by the study as an essential feature of innovation evolution and this gave rise to the general consideration of the concept of knowledge dynamics as a critical aspect of



organisations. The ideas about knowledge dynamics suggested what was a potentially a useful approach for organisational modelling.

In the Exploratory Phase four factors that facilitated or constrained the process of innovation were identified. In light of the initial aims and objectives described above these were considered to be substantive issues. Using three criteria (technological trajectories and core competencies, strategy and the complexity of the environment) six research domains were identified as the focus of the research and a conceptual framework for the study developed. From the different positions of the domains on this framework it became evident that a key component for differentiating between contexts, namely organisational culture was not adequately represented.

It was then possible to adapt the substantive issues to identify a clear aim and associated objectives. The aim was to use “knowledge dynamics” as an approach that could support the development of a conceptual model of organisational culture and thereby contribute to understanding how it affected innovation capability. The objectives included the identification of the key elements that affected innovation capability, the provision of a broader cultural context for these elements through a synthesis of this study with previous BT studies on culture and the identification of the different cultural classifications and their related knowledge dynamics. A number of strategic interventions based on these knowledge dynamics were also sought. These objectives were to be achieved through a case study of innovation within R&D in BT that would provide contextual data and help validate the conceptual model. The Exploratory Phase of work also recommended a multi-method approach to the study.

The aim and objectives were achieved through a three-phase research strategy. This involved looking at a wide variety of literatures, conducting semi-structured interviews, an analysis of documentation and secondary data and an examination of the company Intranet. Interactive workshops with BT management were held at every stage of the research with the purpose of setting direction for the next phase and for feedback.

The aim of using knowledge dynamics as an approach was addressed through the conceptualisation of organisational culture as a repository of knowledge. This was informed by literatures in the areas of knowledge management, organisational behaviour and organisational theory. A wide variety of literatures on innovation studies were also analysed to make the case for looking at organisational culture as an important

determinant of innovation capability and for looking at innovation as a dynamic process. A number of other key literatures were also highlighted in the process of developing the final conceptual model of organisational culture and these are discussed later in this chapter.

The first objective was addressed in Phase One of the research. Semi structured interviews with representatives of the six domains were carried out and seven elements that were perceived to affect innovation capability were identified. Through a synthesis of the conceptual framework and these elements an initial conceptual model of organisational culture was developed (Figure 7.2).

In Phase Two a broader cultural context for these elements was provided through a synthesis of previous BT studies on organisational culture. Six distinctive configurations of cultural characteristics *cultural dimensions* were identified from these secondary sources and were then analysed in terms of the elements derived from the earlier fieldwork. This was the second stated objective.

In Phase Three using additional data collected through semi-structured interviews and the dimensions identified earlier the initial conceptual model was amended and four generic cultural archetypes (cultural classifications) were identified. The knowledge dynamics of these archetypes were then considered and interventions for maintaining them and facilitating the movement between them presented. This was in line with the third and fourth objectives of the study.

All these were achieved through the undertaking of a case study on innovation within an R&D context within BT. This provided the contextual data and helped validate the conceptual model of organisational culture (the four cultural archetypes) as it affected innovation capability.

The contributions to knowledge are presented next.

### **10.3 Theoretical and substantive contributions of the study.**

The contributions to knowledge were both theoretical and substantive.

#### **10.3.1 Theoretical contributions.**

A number of points were raised in the exploration of the relationship between organisational culture and innovation capability. Organisational culture is seen as an important determinant of innovation capability and the innovation process as a non-linear dynamic process that is context specific. This requires context specific responses in its

management. One such response is the ability of an organisation to adapt and change organisational culture in response to its internal and external environment. This is seen as an important requirement for innovation capability.

This thesis through empirical research provides a tool in the form of cultural adaptability in response to change. It provides such a framework by considering knowledge as a dynamic and renewable resource and one that is culturally determined. The value of the specialized knowledge that exists in the processes and routines is also recognized. It conceptualises organisational culture as a repository of knowledge and develops four generic cultural archetypes with their unique knowledge dynamics – “fingerprints”. The different types and forms of knowledge interact dynamically to form an organic system of organisational knowledge and it is this recognition that can provide organisations with the ability to harness its innovation capability effectively. Intervention strategies based on the reconfiguration of these knowledge dynamics provide the key to cultural adaptability and improved innovation capability. It is the different configurations of these specialised knowledge that determine the multiple cultures within which innovation takes place and the understanding of these different contexts is key to managing the process.

The provision of a clearer understanding of these forms of specialized knowledge accompanied by an understanding of their attributes in terms of their affect on innovation capability is an important theoretical contribution of this thesis.

The concept of cultural archetypes that are generic patterns of organisational culture also has implications for the management of organisational innovation capability in that they provide a framework for organisations to assess their own innovation activity. It is possible for an organisation to locate its unique situation within a particular category and to identify and implement some solutions that are appropriate to it. They can also provide a guide as to the mechanisms and resources necessary to move from one position (archetype) to another and to maintain an existing position within a changing environment. Once it is clear that a particular cultural archetype fits the actual situation of the company, there are certain strategies that may be used to give the organisation greater leverage in dealing with challenges from within its operating environment. The cultural archetypes also provide a basic format with some definite prescriptions and points of intervention so that inter-relationships may be easily seen.

The movement between these archetypes in response to opportunities and threats in the operating environment provides organisations the ability to effectively reconcile its responses to ensure stability and flexibility in its innovation capability. Similar strategies by organisations in response to fluctuations in their operating environments through reconfiguration of organisational structures and management elements has been referred to as “cycling behaviour” and has been discussed in Chapter Nine. Similarly different cultural archetypes are appropriate for different organisational contexts. By adjusting the knowledge dynamics of the current cultural archetype to ensure a better “fit” with the requirements of its operating environment the organisation can manage its innovation capabilities effectively and efficiently.

The study therefore develops a local (i.e. firm and innovation based) classification of organisational culture that is new to the literature particularly in terms of its knowledge processing and sharing capabilities.

The core findings of this study have been accepted for publication in a peer-reviewed journal (Lemon and Sahota, 2003). Conference papers have also been presented at international conferences in Athens (Lemon and Sahota, 2002), Cambridge (Lemon and Sahota, 2002) and Luxembourg (Sahota, 2003). The findings have also been well received by *Tekes* Finland (*Tekes* finances industrial R&D projects as well as projects in research institutes in Finland) and interest has been shown by one of the environmental agencies in China (National Cleaner Production Centre sponsored by the State Environmental Protection Administration of China (SEPA)).

### **10.3.2 Substantive contributions.**

These findings have contributed to a better understanding of the importance of organisational culture to innovation capability for the host organisation (BT) in a number of areas. The organisation’s primary concern was its inability to harness innovation capability as reflected in the substantive issues described earlier. This had raised many issues regarding its ability to meet new challenges in its operating environment.

The substantive contributions were made at every phase of the research process through the use of the interactive workshops. These workshops provided an opportunity for the researcher to disseminate the results of the previous phase of work and through a process of discussion and feedback the organisation was able to form opinions and judgements and assimilate these in their working practices.

The identification of the seven elements that were perceived to affect innovation capability was seen as an important step in recognising the barriers and drivers to the innovation process. These provided the organisation with an understanding of the overall picture of the issues that were perceived to affect innovation capability. This important substantive contribution led to the organisation suggesting a synthesis of previous BT studies on organisational culture with this study.

Six cultural dimensions were identified and then analysed in terms of the elements. This synthesis provided an understanding of organisational culture as it specifically relates to innovation capability. This provided the organisation with valuable insights of the broader issues pertinent to human resource management. This was another substantive contribution.

An important substantive contribution was the identification of cultural archetypes with their specific knowledge dynamics that provided the organisation with an understanding of its varying approaches to exploiting its innovation capability. By providing this “map” the organisation was able to determine its current position and identify pathways for future development.

The organisation accepted the notion of cultural archetypes and the ability to move between these archetypes as a valuable concept for improved innovation capability and this became a basis for exploring organisational efficiency, flexibility and the related attributes that contributed to the short and longer-term organisational performance, evolution and sustainability.

In conclusion the research, through the interactive methodology that was employed and the models / frameworks that were generated, responded directly to original concerns about the need for improved clarity about the innovation process and related capability.

#### **10.4 Appraisal of the chosen research method.**

A multiple method approach was adopted for the field-work undertaken in the study. This consisted of semi-structured interviews with management in each of the research domains within BT, analysis of documentation and intranet data sources and a set of interactive workshops with senior and domain management at the end of each phase of work. These workshops responded to the research findings that were presented and in so doing questioned and validated the analysis and provided clarification where necessary. They also helped to plan the direction of the succeeding phase. This iterative

methodology, where the client actively participated in the research process was subject to the difficulties associated with any qualitative work in that there is always room for bias or subjectivity. The mix of technique, data source and analytical procedure attempted to address this issue through ‘triangulation’. The workshops in particular provided a platform for managers to present their views in such a way that the study findings could be questioned as could the different interpretations of how the organisation operated and the efficiency with which it did so. This also provided the opportunity to be critical of BT, an opportunity that was often taken up.

The independence of the researcher can be affected by a continuous interaction with the participants through the use of interactive workshops where personal agendas might affect its outcome. In this case however, it was felt that due to the consensus in the organisation that an understanding of the factors that affect innovation capability needed to be addressed promptly, especially with its changing business model that emphasised flexibility and adaptability, the independence of the researcher was not compromised.

### **10.5 Evaluation of the conceptual framework.**

The conceptual framework differentiated the domains according to the three main criteria (technological trajectories and core competencies, strategy, and the complexity of the environment) that were perceived by senior managers as affecting innovation capability. It was however evident that this provided the “forest” view of the areas within which research was being conducted and there was a need to look closely at the “trees”. This implied looking at the relationships between organisational culture and innovation capability.

In order to progress this the conceptual model was kept as a focal point and progressively developed through the three-phase strategy described earlier in this chapter. The literatures of the criteria used to develop the framework were explored first. Next the framework was synthesised with the seven elements that were identified as facilitating or constraining innovation capability. This resulted in the development of the initial conceptual model of organisational culture. In order to obtain an understanding of these elements, relevant literatures were also explored.

This model was then amended by the analysis of *cultural dimensions* (six distinctive configurations of cultural characteristics) in terms of the elements. This resulted in the subsequent development of four cultural archetypes which were then discussed in terms of

their knowledge dynamics and the implications to innovation capability. This was the “trees” view being sought by the study through the use of the conceptual framework.

To summarise the conceptual framework provided an overall structure within which specific characteristics, the knowledge dynamics, of organisational culture were identified as determining innovation capability of an organisation through a three-phase research strategy.

### **10.6 Implications for further research.**

Four cultural archetypes have been presented as a conceptual framework with the aim of understanding the factors within organisational culture that affect innovation capability. These should be used as a guide for future activity in the area as the usefulness of the model will only become evident through active research. The most intractable area for many managers lies in the *transition between archetypes*. The academic field often skips to “understanding” when organisations are more interested in practical and viable interventions. This is evident in the strategies for maintaining, reassigning and fostering cultural change. The transition between archetypes requires a change in behaviours and further work is required into the practicalities and resources of managing such cultural shifts. Organisational learning should be a central tenant for both a *sustainable* and *feasible* approach to managing movements between archetypes and more work needs to be carried out to broaden the applicability, and deepen the understanding, of this study’s findings in other organisations and contexts. Further case studies using the framework developed in this thesis can help to achieve this.

Further research on the cultural knowledge matrix with the aim of determining its applicability and the identification of further layers within which knowledge resides is required. This would be an important area to explore as a better understanding of these knowledge layers and their characteristics can provide answers to cultural adaptability and the resultant affects on innovation capability.

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Domain analysis: drivers, barriers, down streaming and measurement of innovation.

Table 1: Domain “A”

Domain.	Drivers	Barriers	Down streaming	Measurement of innovation.
Management	Shift in paradigm in the long term; future earnings rather than present earnings; people from industry; customer perception of the market; rewards; walking around and encouraging; no uniform culture, adds diversity; informal and formal (investing in the future) networks; traditional boundary lines disappearing, more interaction; innovation located in day to day activities; flatter, flexible org. proactive; improved communications; share value primary driver; enthusiasm and leadership; most powerful drivers external; emphasis on effort and activity; improvement in teams.	Shift in paradigm in short term; better at innovation than creativity; linking speed with innovation; old appraisal system; high headedness; the thinking; no flexibility in allocating budgets; centre of gravity complacent; the “British” way of thinking; not invented here syndrome; becoming overly innovative and becoming mavericks and losing the plot; senior leadership to horn their skills or leave; not open listening culture; engineering culture; too much internal focus; formal structures to capture knowledge do not work; business case process.	New ideas scheme; local level and new product level; informal methods as borne out by the European quality models.	In comparison with other telecom companies; DTI survey; revenue generated; European quality model, money spent, bench marking, measuring cultural aspects, care questions; changes in perception of company; hard to measure, it’s subjective; BT still at forefront on new markets.

Table 2: Domain “B”

Domain	Drivers	Barriers	Down-streaming	Measurement of innovation
Business modeling unit	Benefit of what you have learnt; young people; training; autonomy; interaction between product lines; world-class facility; center of excellence; well defined interfaces PDI; redundancy gives serendipity; firm direction from board; informal channels; flexibility in work practices; BT becoming an adaptable business; idea should have sound commercial outcome.	No serendipity; cultural, social issues; organizational structure; management issues. Not invented here syndrome; processes; finding product champions; people issues; decision making processes; politics and power; risk taking; leadership issues; identifying a business partner; making a business plan; resources; vision and strategy; no good way of capitalizing on ideas; finding a sponsor; lack of vision and coherent strategy; constant reorganization, BT is a set of fiefdoms; Innovation does not locate in day-to day activities.	External and internal publicity; innovation process; informal ways; formal proposals through corporate office; regular customers’ ADP type of work; producing and showing demonstrators; personal contacts, direct corporate funding.	Difficult to quantify innovation because of the difference in the business of innovation and invention Patents; adapted for use; publications.

Table 3: Domain “C”

Domain	Drivers	Barriers	Down-streaming	Measurement of innovation
Advanced Media unit	Business sector as a bridge; working part time with business sector; scanning; move from technology push to business drivers; presenting at major BT events; does not hold position for delivery; BT re-organization to encourage risk taking; personal change- not afraid to take risks; creating the right context, run real customer trials; in touch with external realities; ability to interact outside the business e.g. DTI, keeping interests alive.	Matrix and line management; increasingly focusing on the short term - profit; not building and skills lost; gap in the thinking between front end of business and research; complexities of the business; acknowledge technical expertise instead of promoting to manager; lack of autonomy; rewards; business sector does not want technologists to muddy the water; no skunk money, no free spirit; marketing wants to sell today's products; finding the right people in organization to communicate with; writing a business case; risk averse; middle management; cycles of frustration, occasional periods of enlightenment; pushing out innovations before fully developed – lack of funds; gap between creating interest and creating funding; no framework for innovation; filtering process; lack of wider perception; reputation of rocking the boat; lots of changes in different directions; inadequate rewards, unable to recognize technical skills, losing talent; high turnover.	External publicity campaigns; internal publications; central corporate funding program; big gap in down streaming between long term funding-very research oriented and ADP; identify potential customers; ground work in actually expanding the idea and explaining potential business impact; prior to Brightstar, license technology.	Reputation built; demand on dept.; influence on the people who put the demand.

Table 4: Domain “D”

Domain	Drivers	Barriers	Down streaming	Measuring of innovation.
Brightstar	Acknowledge there is a problem; learn by failing; changing the mindset of people coming forward; the organisational and environment created and employees and senior mgrs. endorsing it; people skills from outside that have been brought in; no processes but guidelines; having a budget that allows resources required to be brought in; virtual teams; profit, shareholder value; excitement and passion; support from the top-flexibility; risk taking; working differently from the rest of BT; find win-win situations; improve by learning;  Mgt team selected on personality; Monday morning meetings to create passion; create network type of events; budgets available for trying new ideas; Executives on boards of start ups; duplicate customer functionality; create MBA type of teams with access to the board; drop in sessions.	BT avoids failure not create success; limitation is that if the business is not going to create £100 million, Brightstar would not create it; limited team, only open to ACE site, old culture of trying to negate Brightstar; processes, the procedures designed to say no; reward, English problem, English culture; senior management who want to control instead of endorse; perception of Brightstar by senior mgrs. Who think that they are losing their people; difficult to find people inside BT who understand what Brightstar is about; nothing in the system encourages people to be entrepreneurs; risk reward profiles are stacked against success; bonus system pathetic; does not know how to capitalize on ideas and the knowledge it has; middle mgt biggest “choke”; BT is all command and control, a political flavor, mgt with a ego; knowledge mgt terrible; people shy away from responsibility and are frightened; budget process.	Federated research university contacts; innovation already done before it gets here; investing in a great team and a good idea; joint ventures and spin offs; investment opportunities in I/C; working bottom up; incubator; drop in sessions.	Equity.

Table 5: Domains “E” and “F”.

Domain	Drivers	Barriers	Down-streaming	Measurement of innovation.
e-business technology futures  Next generation Internet research	Understanding business needs and strategy and looking for ways to full fill those needs; informal methods; building up expertise; keeping up to date; building up expertise; reputation of being closely coupled to business units, actively closing the gap; ADP projects purely corporate funded, have more steer to it, and closely relationships with internal customer; encouraged to take responsible risks; guts and experience and understanding the business; learning culture; strategy constrains where you put your work in innovation; Identified 10 technologies for research focus.	Rigid processes; not radically risk taking; not a first mover; hard to drive the ideas right through, endless obstacles; transfer of authority as you move through different teams, convincing different people; business plan; people analyzing it do not have the insight at the front end of the business, cannot take the risk because of all the rationalizing; people in front end of the business are not far ahead in their thinking; taking the guaranteed return approach; difficult to get onto radar screens of product lines; keeping staff enthusiasm and morale high even when business is not responding to their ideas; disenchantment; workers perception; size of company- long way removed from the day to day activities; filtering problem; ideas changed as they move through various stages.	Innovation processes, most of the processes are rationalizing about what goes on; customer driven; fusion of ideas by people meeting up; informal networks; presentations and promotions; reputation; Influence the thinking, the strategy of suppliers and partners; personal initiative; getting access to tacit knowledge.	Number of new business opportunities identified and managed to get onto peoples' agendas; New product and services; change in perception and thinking; publications; change in the processes; who you have influenced; new business opportunities; forefront of new markets; expertise generated; consultancy.

**Appendix 2**  
**BT documentation.**

<b>Document ID.</b>	<b>Purpose of study/reports</b>
Internal document A.	<ul style="list-style-type: none"> <li>•Obtain a holistic view of organisational culture.</li> <li>•To suggest the most suitable measures and measurement methods to continue tracking BT's culture, values and communications in the future.</li> </ul>
Internal document B.	<ul style="list-style-type: none"> <li>•To identify attributes or attitude clusters which could predict the culture.</li> </ul>
Internal document C.	<ul style="list-style-type: none"> <li>•To identify mismatches between various sub-groups/sub-cultures (e.g. internal and external perceptions, board/senior management and employees views and expectations.</li> </ul>
Internal document D.	<ul style="list-style-type: none"> <li>•BT guides in areas such as action planning, team working, learning and development, basics to good people management and investing more in your people.</li> </ul>
Internal document E.	<ul style="list-style-type: none"> <li>•To identify cultural shapes to reflect differences in existing cultures within BT.</li> </ul>